The Chemical Age

VOL LXIII 16 DECEMBER 1950 No 1640

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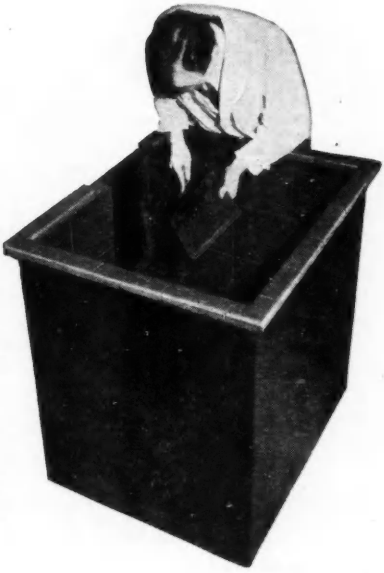

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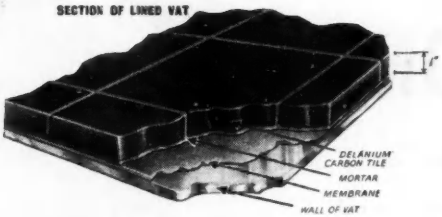

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The
Chemical Age

The Weekly Journal of Chemical Engineering and Industrial Chemistry

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The Shortage of Drums

THE shortage of steel drums is becoming increasingly serious and the position is deteriorating from week to week. Inquiries reveal that drum manufacturers are from three to six months behind with their orders, the reason being that factories are working at half capacity owing to reduced allocations of steel.

While the effects of the drum famine are being felt by many industries and trades, the chemical industry is among the principal sufferers because so many of its most important products are handled in drums. Already the home market is being deprived of essential supplies and export orders are delayed because the drum factories cannot meet demands.

Yet the chemical industry has been urged to increase its output and step up exports, particularly to dollar countries. The industry has responded magnificently to the dollar drive and it is ironical that its efforts should now be frustrated because there are not enough drums to cope with the increased production. This critical position has arisen just when chemical manufacturers had reason to be well satisfied with the results of their export drive.

But this is by no means the whole story. Apart from direct exports, chemicals are despatched—again in drums—to other home manufacturers for use in the production of various commodities, which are also exported on an extensive scale. In many instances the value of materials added far exceeds the value of the chemicals used. Thus a drum shortage at a single factory can stifle many other industries whose own products may not necessarily be sold in drums.

The Association of British Chemical Manufacturers has been making urgent representations to the Board of Trade, but the outcome is not yet known. It is understood that the matter has also been taken up by other affected trades.

Nobody seems to know just why allocations of sheet steel to drum manufacturers should suddenly have become so inadequate. Two reasons suggested are the effects of rearmament and increased steel consumption by the motor trade. The steel industry continues to break new records, but it is quite evident that sheet steel is still being consumed as rapidly as it can be produced. The position will no doubt be greatly eased when the new plant at Margam comes into production next year, but until the country's requirements can be met in full, some industries are bound to suffer, no matter

what system of allocations may be introduced.

There would nonetheless appear to be a very strong case for increasing allocations to drum manufacturers, even if this involved a slight reduction in supplies earmarked for other essential purposes. Britain's consumption of steel drums is believed to be five or six million a year, so that the tonnage involved is small in comparison with that of the largest sheet steel users. The opinion has even been expressed that the very welcome benefits resulting from increased motor car exports might be more than counterbalanced by the reduced shipments of chemicals, oils, paints and other commodities transported in drums.

It should be remembered, too, that nearly all major industries are to some extent dependent directly or indirectly on supplies which are delivered in drums. The motor car industry, for instance, uses enormous quantities of paints and varnishes. Many of the ingredients of these materials are delivered to the paint factories in drums. Thus it is conceivable that if the drum famine cannot be alleviated, the effects will eventually be experienced by the motor trade. Again, it is urgently necessary in the existing circumstances that the highest priority should be accorded to the rearmament programme, but even rearmament depends on drums for many of its essential requirements.

In certain industries the crisis may be eased to some extent by bulk deliveries to the larger customers, but this is clearly impossible in the case of small concerns whose aggregate purchases of material in drums are very great.

So widespread are the potential consequences of the drum famine and so damaging the repercussions on both home economy and export trade, that the plight of the drum factories and their customers seems to call for immediate action at the highest level. Means should be found for increasing steel allocations to manufacturers to quantities more nearly commensurate with demand. If this can only be achieved by robbing Peter to pay Paul, it should be remembered that in this instance Peter's prosperity is vitally dependent on that of Paul.

Technical and Scientific Register

The total number of persons enrolled on the Technical and Scientific Register at October 16 was 5575, which included 3936 registrants in work but desiring a change of employment and 1639 unemployed. During the five-week period September 12 to October 16, 529 vacancies were notified, 329 were filled and 387 cancelled or withdrawn.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 30s. single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3970). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes and Comments

The Future of Plastics

SOME revealing facts about the problems affecting the plastics industry in many parts of the globe were given by Mr. R. E. G. Windsor at a Press conference held in London recently, on his return from a 40,000-mile business flight.

The major factor affecting plastics in the U.S.A. was, he said, the shortage of raw materials, particularly polystyrene which originates from benzene. Benzene is now being appropriated for the synthetic rubber plants. Until it can be decided therefore, how much synthetic rubber will be required and the amount of benzene involved, the full effect on production of polystyrene cannot be foretold. Already two American chemical companies are working on a substitute for benzene for use in synthetic rubber plants. There is no shortage of polyvinyl chloride.

Extrusion of plastics, pointed out Mr. Windsor, was now in the stage reached by injection moulding in 1936. Extrusion was, however, of greater importance industrially and chemically, as injection moulding was mainly for decorative or luxury goods. In Japan, Windsor, Ltd., had supplied the first extrusion machines and there were great potentialities for plastics in that country.

Many new industrial applications in Australia were being rapidly developed, and despite a shortage of technicians there were good prospects for the plastics industry. India presented many problems, partly due to the fact that the people were not technically minded. On the other hand, Pakistan was determined to rise industrially and was making great strides forward. The new trading estate outside Karachi included very up-to-date plastic factories. Generally, it was found that there is a definite desire for British plant at the right price if it can be backed up by servicing and availability of spare parts, while in Asia and the Far East British firms must have home-trained technical representatives on the spot.

Appreciation Lacking

THE character and personality of the Chancellor of the Exchequer is of special interest and importance to the business world. More than any other minister, he touches the practical work of the nation at every point. The office ranks next to that of Prime Minister and the list of its holders before 1945 consists of names that the nation and the world have held in the greatest respect.

The young man who has now been chosen to carry on these great traditions, has not so far shown an adequate appreciation of his responsibility for behaviour befitting his robes. He surprised the House of Commons by refraining, in his first speech, from any reference to his predecessor and thus made a breach in a treasured Parliamentary tradition. Without any suggestion of approving the policies or practices of Sir Stafford Cripps, it can be agreed that he maintained the good manners if not all the dignity, of high office.

When some little time ago, as Minister of Fuel and Power, Mr. Gaitskell announced that he was giving up his daily bath, he was thought to be playing a little below the form expected from Winchester and Balliol, but was excused for a gaucherie which any youth may by mistake perpetrate when only, in fact, endeavouring to be funny.

When, however, last week he went the length of taunting Mr. Churchill, of all men on earth, with " lacking in humanity ", the new Chancellor disowned his educational advantages and joined forces with the vulgar minority of his colleagues. Even though in his forthcoming Budget Statement he may not use the gutter terminology of this low group, his victims must expect to find themselves treated as vermin whose opinions are worth less than a tinker's cuss.

SEVEN YEARS OF FUEL RESEARCH*

AT THE outbreak of the war the whole of the experience and information of the Fuel Research Board was held available for application to the war effort, and in a comparatively short time practically all of the staff were engaged on wartime programmes, widely varying in character.

Mention should be made in the first place of the immense advantage derived from the valuable information amassed by the Coal Survey, in the inter-war period, on the properties of the coal resources available in the country. The knowledge acquired by the Coal Survey provided a valuable basis for many of the projects attempted during the recent war, particularly those which were concerned with requirements of coal possessing special properties. In addition, much work was done by the Survey Laboratories in connection with the substitution of fuels to conserve certain types of coal and to eliminate all unnecessary transport. Assistance was also given to the sulphuric acid control of the Ministry of Supply in the recovery of pyrites from coal.

Petrol Substitute

The threat of war had caused several projects to be put in hand prior to 1939. In particular, work on the use of producer gas for road vehicles as a substitute for imported petrol was started at the Fuel Research Station as early as 1937, when the "Hartley" Committee was set up by the Minister for the co-ordination of defence. An intensive investigation was undertaken by a team of workers at the station, and other organisations undertook co-operative work. By 1940 the well-known Government emergency producer was evolved, and this was later improved and modified for mass-production as the Government utility producer.

In 1939 the Air Ministry arranged for the erection of hydrogen plants at gas works in various parts of the country. The Fuel Research Station had been producing hydrogen in full-scale plant for its programmes on the hydrogenation of coal and tar before the war, and the facilities and experience of the station were placed at the disposal of the Air Ministry, and a valuable and substantial contribution was made to the barrage-balloon defences throughout the period of the war.

In 1940 work on flame warfare was begun, to assist the petroleum warfare committee. Here again the station staff made a contribution of first class importance to the war effort. A team of workers carried out experimental investigations on incendiary materials for many purposes, including fougasses and flame-and-smoke barrages, but the outstanding achievement was the preparation of new highly-effective fuels for flame throwers, which were manufactured and used in large quantities.

Another important contribution was the development of smoke-eliminating devices for the elimination or reduction of smoke from the funnels of merchant ships. The same principles were subsequently applied on land to Lancashire boilers, and smoke-eliminator doors of the Fuel Research Station design are now being manufactured.

Another successful investigation undertaken, although not connected directly with the war effort, was that relating to the problems arising from the deposition of solid matter on the external heating surfaces of boilers at power stations. This work was carried out in co-operation with the boiler availability committee which consisted of representatives of the Central Electricity Board, the electricity-generating industry, manufacturers of water-tube boilers, and the British Coal Utilisation Research Association. Excessive formation of these deposits in power-station boilers necessitated frequent shutting-down of the boilers for extensive cleaning and has thus seriously decreased their 'availability.' With the shortage of generating plant, this has caused great concern to the electricity supply industry. It is satisfactory to find that the station's work has been of considerable assistance in alleviating the difficulties, and that it has been much appreciated.

Fischer-Tropsch Process

Finally, it should be mentioned that work on the Fischer-Tropsch process of synthesising oil from coal was continued throughout the war years although restricted to a small scale. The information obtained in this way enabled advice to be given to the Ministry of Fuel and Power on the possibilities of the process and to assist the Ministry of Economic Warfare in matters concerning the role played by the process in the war-time economy of the enemy nations. It was also of particular value in the planning and carrying out of the investigations of the Fischer-Tropsch industry in Germany in the spring and summer of 1945.

* A brief survey of "Fuel Research, 1939–1946," published by DSIR and available from H.M.S.O., 3s.

JAPANESE CHEMICAL RECOVERY

SOME idea of the extent of the war damage to Japanese chemical industries may be derived from the fact that in several cases capacity has been affected by as much as fifty per cent. The chief users of chemicals have also had their productivity considerably reduced; for example, rubber has fallen by 43 per cent, cement by 20 per cent, oil refineries by 58 per cent and wool textiles by 34 per cent.

Giving these facts and figures (*Chem. Industrie*, 1950, *2* (11), 553-5), Alexander Nagai, of Tokio, says that the original demolition and reparations policy of the Allies, as recommended by the Pauley Mission, extended far beyond war material factories. It was, however, subsequently modified on further consideration by the Strike and Draper Missions which stipulated the following approximate capacity limits (in 1000 tons)—nitric acid (54), sulphuric (4755), electrolyt. caustic soda (128.8), chlorine (113), soda 493), aluminium (151), magnesium (0.2), tar distillation (349), light oil distillation (137), celluloid (6), methanol (19).

Fuller details of the effect of war damage upon Japanese productive capacity may be assessed from Table 1.

TABLE I

	Pre-war capacity	War damage	Per cent.
Sulphuric acid			
Contact	2,564.5	86.4	3.4
Lead chamber ...	3685.7	818.9	22
Ammonia	511.1	226.5	44
Ammon. sulp. (synth.) ...	1,819	847	49
Calcium nitrate ...	321	8	2.5
,, carbide	376	6	1.6
Superphosphate ...	2,353.4	403.8	17
Hydrochloric acid ...	220.9	71.9	33
Caustic soda			
electrolyt	236.4	49	21
ammon. soda ...	415.8	208	50
Soda	889.2	342	39
Aluminium oxide ...	354.5	49.7	14
Coal tar	339.3	60.2	18
Benzol	93.4	25.6	27
Fatty acids	112.8	19.4	17
Hydrogenated oil ...	80.5	40.2	50
Soap	161.3	61.7	38

The entire demolition problem in Japan is still not finally settled. Prevalent opinion is that it will be still further lightened by the U.S. authorities. Several synthetic fuel factories—among which are three Fischer-Tropsch and three high pressure plants—and fertiliser factories may be spared. Food supply is the paramount need for Japan's huge population, so that the fertiliser industry takes pre-eminence.

Output of synthetic nitrogen already far exceeds that of pre-war as indicated by the figures for 1949: 1,147,522 tons ammon. sulphate (synth.), 34,648 tons by-product ammon. sulph., 6038 tons urea (45 per cent N), 347,550 tons calcium nitrate (20 per cent N), and 188,560 tons ammon. nitrate (32 per cent N) But the total is still less than the estimated home demand of 2,152,000 tons. Superphosphate is still below pre-war output. In 1949, production was 1,231,478 tons. Imports of potassium chloride (40 per cent K_2O) of 261,217 tons amounted to only half the estimated need of 490,700 tons.

Marked Progress

On the other hand, production of calcium superphosphate (16 per cent P_2O_5) has increased rapidly during the past few years (in 1000 tons): 1947, 709; 1948, 955; and 1949, 1161. It is hoped that the nitrogen industry will, in future, be able to meet all home demands, and also provide a balance for export. Several orders for ammonium sulphate have been received in recent months from Thailand, Formosa, and Hong Kong.

Particular attention is being directed to the manufacture of triple-super, mixed fertilisers, and urea. For the last-named four factories are already engaged on the production of urea but only one supplies urea for fertiliser purposes, the output of the other three is apparently being used for plastics. The fertiliser factory is that of the Toyo High Pressure Works in Sunagawa, with an annual capacity of 15,000 tons. The other three, for plastics and synthetic resins, are much smaller. The erection of five new plants for urea contemplated, includes one for the Nisshin Chemical Works of Niihama, contract for which was given to the Chemical Construction Co., of New York, in July or August of this year. Production of ammonium chloride and phosphate for fertiliser use is also to be increased.

In other sections of the chemical industry progress has not been so marked, but nevertheless quite appreciable advances have been made. Taking the production index of 1932-36 as 100, it was 142.4 in 1943; 102.6 in 1948 and 138.5 in 1949. It is likely to be still higher for 1950. Actual output figures for some of the more important in the heavy chemicals group are given in Table 2.

TABLE II

	1936	1947	1948	1949
Soda ash	232	38	75	123
Caustic soda ...	299	43	107	145
Liquid chlorine ...	10	4	6	10.5
Calcium chloride ...	68	14	27	34
Sulphuric acid ...	2,891	1,489	1,950	2,582

In 1936, organic dyes amounted to

19,000 tons. For 1948 the figure was 5000, and for 1949, 6600 tons. For this year, if the export trade can be further stimulated, it is anticipated the output will be much greater.

Soap production is still far below requirements. It was only 25,000 tons in 1949 compared with the 1936 figure of 192,000 tons. In plastics and synthetic resins better progress is anticipated under American planning, especially for polyvinyl chloride. Insecticides are now sufficient to meet home demand, and this year it is hoped that exports of lead arsenate will reach 2000 tons.

BRAZIL'S TRADE WITH U.K.

DURING the first nine months of 1950 Brazil imported from Great Britain chemicals, drugs, dyes and colours to the value of £3,993,839; disinfectants and insecticides, £84,748; sodium carbonate, £423,870; caustic soda, £1,346,695; drugs, medicines, etc., £211,324; finished dyestuffs, £245,823; paper and cardboard, £439,179. The total value of imports from the United Kingdom amounted to £30,904,495, as compared with £33,976,000 during the whole of 1949.

During the period under review Brazil's exports to the United Kingdom of chemicals, drugs, dyes and colours amounted to £238,326.

Imports and sales of imported chemical products are now controlled in Brazil by the Central Price Commission. Stock lists are being compiled to prevent shortages and increased purchases abroad are expected. Importers and re-sellers may not add more than 30 per cent to the cost by way of profit. The list of controlled products includes nearly all the principal industrial and pharmaceutical chemicals.

Reserves of alkalis are low at the moment, presumably owing to the delay in granting licences to import from Britain, Brazil's principal supplier. Permits are to be granted more freely.

Local production of pyrethrum in Brazil rose to 2620 tons during the war, when about 1000 tons were exported annually to the United States. The price was fixed by agreement between governments at 35 and 26 U.S. cents per kilo for first and second quality flowers, respectively. After the war DDT and other new insecticides appeared on the market, causing the price for pyrethrum to drop to 16 cents; and planters in the State of Rio Grande do Sul lost interest. Later, a big demand in Brazil and orders from Argentina drove prices up to 28 cruzeiros (11/2d.) per kilo. Planting was immediately resumed and production in 1950 is expected to reach 13,000 tons.

Brazilian planters are now alarmed by the report that the Union Carbide & Carbon Corporation, of New York, is producing allethrin, which they claim contains no natural tars and resins to clog spraying equipment, and has less odour.

The Brazilian growers fear that it will be produced in large quantities and at a price which will discourage planting.

Steel Corrosion Tests

THE results of experiments on the corrosion of bare iron or steel in sea water have been described by Dr. J. C. Hudson, of the British Iron and Steel Research Association, in a paper in the *Journal of the Iron and Steel Institute* (*166*, 123). Minor variations in composition and structure, it was found, had no significant effect on the rate of corrosion of ordinary mild steels when immersed in sea water.

The results of tests with a wide range of elements added to low-alloy steels showed that only two (chromium and nickel) had an appreciable effect in reducing corrosion. Chromium had the greater steels with 2-3 per cent chromium corroded at one-half or one-third the rate of unalloyed steel influence.

There were indications—"the conclusions can be put no more strongly than this"—that corrosion of ordinary steels by sea water increased when their carbon content rose above 0.4 per cent and was greater for steels with high manganese contents. Some increase in corrosion resistance might result from the introduction of small percentages of aluminium or beryllium in the steel.

There was no conclusive evidence that the presence of copper alone in the steel had any beneficial effect, although it possibly might be of value when an increased percentage of phosphorus also was present. The presence of millscale was shown to promote serious pitting in seawater.

Dr. Hudson states that to confirm the effects of alloying steel with chromium and/or nickel, tests on large specimens rolled from full-scale commercial heats are needed, and that it would be at least of scientific interest to investigate further the effects of high carbon content, high manganese content, and of beryllium additions by tests of the same type.

LABOUR AND THE CHEMICAL INDUSTRY

NUMBERS of persons associated with the chemical and allied trades at the end of September were 458,000, an increase of 4000 over the figure at the end of August and 25,000 more than at the end of 1948, according to the analysis of civil employment in the *Ministry of Labour Gazette* (Vol. 58, No. 11).

Changes in the level of employment on the industrial analysis relate to employees only and exclude employers and persons working on their own account. The total numbers in Great Britain employed in chemicals and allied trades (in thousands) were 453.0 in September compared with 449.1 in August and 420.9 in mid-1948.

Detailed distribution for September was as follows (in thousands): coke ovens and by-product works 17.2 (16.7 men, 0.5 women); chemicals and dyes 206.5 (153.0 men, 53.5 women); pharmaceutical preparations, etc. 34.6 (13.9 men, 20.7 women); explosives, etc. 37.2 (22.6 men, 14.6 women); paint and varnish 39.0 (27.7 men, 11.3 women); soaps, candles, glycerine, etc. 50.6 (29.6 men, 21.0 women); mineral oil refining 36.6 (30.4 men, 6.2 women); other oils, greases, glue, etc. 31.3 (24.2 men, 7.1 women).

A rise in numbers employed was also noted in industries connected with the treatment of non-metalliferous mining products other than coal. The total figure for September was 319.4 thousand, which was 900 more than in August and 12,500 more than in mid-1948.

Unemployed persons (all classes) who were registered on October 16 showed 4969 (3324 men and 1645 women) in the chemical and allied trades, and 3510 (2732 men and 778 women) in the treatment of non-metalliferous mining products other than coal.

Union Membership Lower

Membership of trades unions associated with the chemical and allied trades at the end of 1949 was lower than in the previous year. Comparative figures of industrial distribution show a total of 20,150 (14,080 men, 6070 women) in 1949, compared with 20,330 (14,180 men, 6150 women) in 1948. In the treatment of non-metalliferous products other than coal, membership in 1949 was 31,990 (15,440 men, 16,550 women) as against 32,970 (15,860 men, 17,110 women) a year earlier.

Fewer fatal industrial accidents were recorded in October than in the previous month, the total of 117 comparing with a revised figure of 220 in August and 114 in October, 1949. In the chemicals, oils, soap, and allied industries deaths amounted to 10, which was four more than in September. Metal conversion and founding were next highest, with a total of eight. Clay, stone, cement, pottery and glass, also paper, printing, etc., accounted for two each, and gas works for one.

Cases of Poisoning

No deaths were recorded in the U.K. in October under the Factories Act, 1937, or under the Lead Paint (Protection against Poisoning) Act, 1926. Total cases reported were 43, as follows: Lead poisoning, five; mercurial poisoning, one; anthrax, three; epitheliomatous ulceration (skin cancer) 20 (pitch, seven; tar, 12; oil, one); chrome ulceration, 14 (manufacture of bichromates, three; chromium plating, 11).

The use of siliceous parting powders in foundries was the subject of new regulations made by the Minister of Labour and National Service, entitled "The Foundries (Parting Materials) Special Regulations, 1950," which came into operation on December 1.

The regulations, which are in technical terms carefully framed in consultation with industry, prohibit the use as parting powders, in connection with the making of metal castings, of certain materials which involve substantial risk of silicosis to the workers. These materials are (*a*) materials containing compounds of silicon calculated as silica to the extent of more than 3 per cent by weight of the dry material, and (*b*) dust or other matter deposited from a fettling or blasting process.

The prohibition does not extend to natural sand or to six substances specified in the schedule to the regulations if (in either case) the material does not contain an admixture of any other silica. The excepted substances are: zirconium silicate (zircon); calcined china clay; calcined aluminous fireclay; sillimanite; calcined or fused alumina; and olivine.

Copies of the regulations (*S.I.* 1950 *No.* 1700) can be purchased from H.M. Stationery Office, price 1d. net (2d. post paid).

Nylon from Seaweed

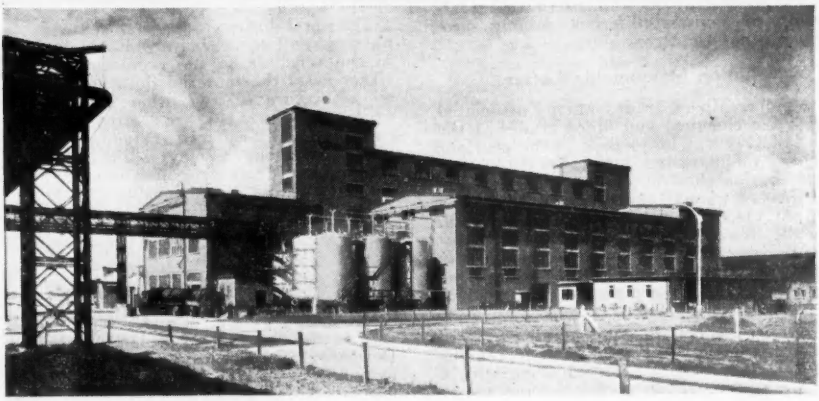
Mr. James Dillon, Minister for Agriculture in the Republic of Ireland, stated on December 9 that he was having plans examined to make nylon from seaweed and newsprint from peat.

PROGRESS AT WILTON

THE satisfactory advance that has been made on the 2000-acre site now being developed by Imperial Chemical Industries, Ltd., at Wilton, North Yorkshire, is shown in these photographs. They are the first official pictures taken since the £22 million scheme was inaugurated by the chairman, Lord McGowan in September, 1949, when he described it as "the greatest single project in British chemical history."

Some 3500 workers are at present employed on the site, 3000 on constructional work and the remainder in manning plant already in operation.

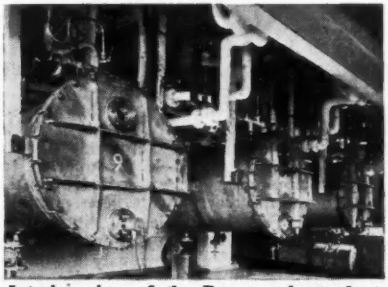
Part of the plant for the manufacture of olefines which have a marked chemical activity, is seen on the left with two circular vessels for the storage of gas under pressure in the background. Below: An exterior view of the PF resin and powder plant



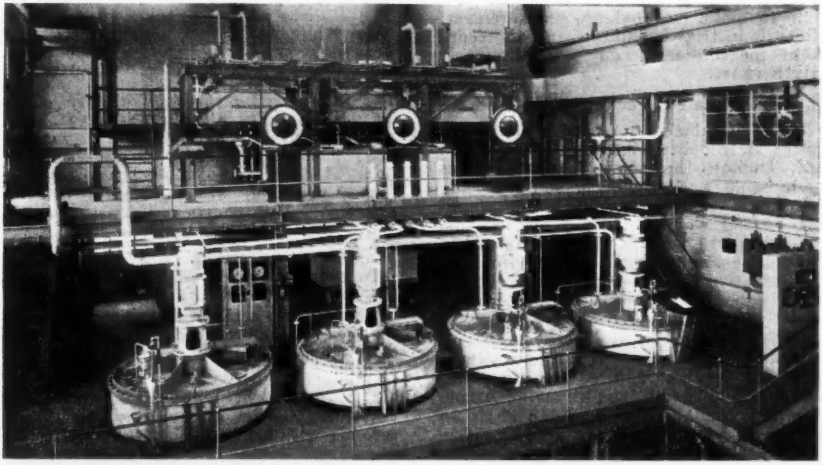
This giant group of chemical installations will yield many new or uncommon chemical materials. The first two divisional plants to come into operation were those of the Plastic division for the manufacture of phenol-formaldehyde (PF) and Perspex acrylic resin for which there is an increasing demand at home and overseas.

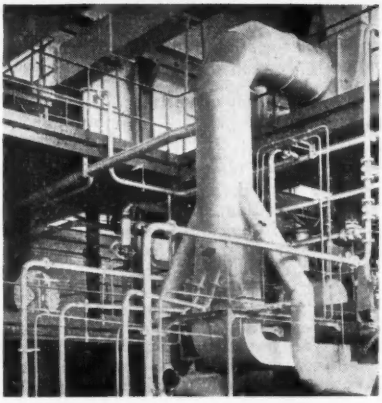
Other installations in the course of construction include a petroleum cracker which will produce ethylene, methane-hydrogen, propylene and butane from crude oil.

The Wilton site and its services will be available to any of I.C.I.'s 11 *manufacturing divisions that require them for new factories.*



Interior view of the Perspex sheet plant





Two interior views of the phenol-formaldehyde resin plant. In the picture above can be seen the supply tanks containing formaldehyde, aqueous phenol and cresol

Completion of the Wilton scheme which was first announced nearly five years ago will enable fresh investigations to be carried out but it should also be remembered that it stands as a concrete example of the results of intensive research on which I.C.I. spend £4 million a year.

This site will also be used to locate the first plant to make the new synthetic fibre Terylene on a commercial scale.

NULL BALANCE MEASUREMENTS

A Self-Balancing Recorder for Industrial Use

IT has long been claimed that where electrical measurements having a high degree of accuracy are required, a null balance measuring system is superior to methods employing deflecting instruments. Only in recent years has it been possible to apply this principle to industrial instrumentation, as conventional potentiometers and bridges previously available were suitable only for spot readings by a trained operator.

With the introduction of mechanically self-balancing instruments it became possible to make null balance measurements under industrial conditions and to record these measurements on a continuously driven chart.

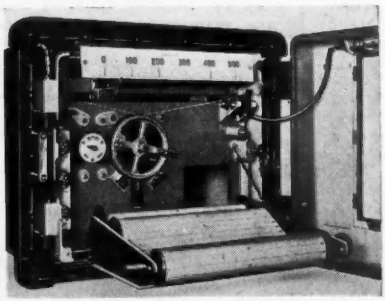
Latest Technique

The self-balancing recorder developed by the Metropolitan-Vickers Electrical Co., Ltd., employs the latest technique in this field, being a continuously self-balancing instrument using electronic power amplification and a motor drive. This principle not only gives a true continuous record of a rapidly changing variable, but eliminates the sensitive galvonometer and complicated feeler mechanism associated with earlier instruments.

Extreme reliability is thereby obtained, and the design lends itself to the construction of apparatus required for use under arduous industrial conditions. Ample power is available at the main shaft to operate alarm contacts or an automatic controller, and the high speed and sensitivity make it suitable for automatic control work where lags and " dead time " must be minimised.

For recording temperature from a thermocouple the instrument is arranged as a d.c. potentiometer. A fixed voltage is maintained across a slidewire by means of a rheostat and an air-depolarised dry battery which has a long life (about 12 months continuous running).

Every 15 minutes this voltage is balanced automatically against a standard cell and readjusted if necessary by means of a motor-driven rheostat. The millivolt output from the thermocouple is compared with the voltage across the slidewire, and the difference voltage is amplified and used to drive the potentiometer to balance, at the same time driving the pointer and recording pen to the correct position corresponding to the input millivolts.



[By courtesy of Metropolitan Vickers Electrical Co., Ltd.

The instrument records on a strip chart 10 in. wide. The roll chart is 120 ft. long and is driven by a self-starting synchronous motor through a six-speed gear box. A chart speed of one, two or three inches per hour or per minute can be selected. The chart drive assembly is shown lowered for changing

In order to use a stable a.c. amplifier, the uni-directional difference voltage is converted into a mains frequency alternating voltage before amplification. This is done by a special vibrator type converter of proved stability.

The instrument is rapid in operation, traversing the ten-inch scale width in two seconds with no overshoot. An accuracy of $\pm \frac{1}{4}$ per cent of full scale is claimed for all ranges above 1 mV, and the accuracy is unaffected by reasonable changes in supply voltage and frequency or ambient temperature.

High Sensitivity

When used in conjunction with a thermocouple, automatic compensation for cold junction temperature changes is provided. The d.c. potentiometer can be used for recording any variable that can be converted into a uni-directional voltage. The extremely high sensitivity of the instrument enables it to respond to input signals of less that one microvolt, the minimum full scale range being 500 microvolts. The maximum permissible input-circuit impedance is about 100 ohms for a range of 1 mV, but this impedance can be increased on higher ranges.

BRITISH CHEMICAL STANDARDS

THE increased demand for British Chemical Standards, both at home and abroad, was stressed by Mr. P. D. Risdale in a report given at a meeting held by the Bureau of Analysed Samples, Ltd., at York on 28 November.

Supplementing Mr. P. D. Risdale's remarks, Mr. N. D. Risdale gave a brief historical account of the standards movement and an outline of progress made in the last 12 years.

In July 1938 (he said) there were 41 standard samples available, representing about 200 standardised elements or constituents. This year 68 standardised samples are available, including eight pure metals or reagents and eight spectrographic standards. These represent something like 350 standardised elements or constituents.

In order to get the maximum homogeneity, we now aim at getting thin curly machinings which remain on a 60 mesh sieve and pass through a 10 mesh. There are approximately 300 particles per gram of steel, apart from some of the smaller material between 30 and 60 mesh.

We continue to take precautions to remove moisture and, in some cases, oxygen from the containers in which we store the machined steel—especially that which is required for determining sulphur by the evolution process. The same precautions are observed for crushed ferro-alloys.

During 1938, and again in 1947, he had visited the National Bureau of Standards, Washington, U.S.A. Generally speaking, their system was very similar to ours.

Common Applications

Many are familiar (Mr. Risdale continued) with the common applications of the standard samples. They are used mainly for checking routine analyses by making concurrent determinations of the standard sample with a batch of routine samples. They are also used for making similar checks on specific samples which have compositions bordering on a particular specification, such as sulphur in the region of 0.050 per cent. Another use is for checking new methods of analysis. These frequently appear in the technical periodicals, and often include a number of tests made on BCS samples as evidence of the accuracy of the methods in question.

A more recent use is for the preparation of graphs for photometric methods, especially since it has been possible to have standards which show progressive increments of different elements in ascending order, such as Si, Mn, Cr, Ni, Mo, etc. This is particularly useful in the case of Si. The preparation of a standard soluble silicate solution is not very easy and it is also difficult to preserve the alkaline solution, which attacks glassware.

Some more recent methods, such as the combustion sulphur procedure, are absolutely dependent upon chemical standards. Similarly, spectrographic standards are completely dependent on the accuracy of the chemical analysis of the standard rods.

1200 Using Standards

There are about 1200 laboratories using these standards in Great Britain including the Admiralty, Air Ministry and Ministry of Supply; universities, technical colleges, independent analysts, chemical manufacturers, engineers, founders, as well as hundreds of works chemists in the iron and steel industry.

Speaking in general terms the accuracy of analyses made in connection with the standardisation has improved considerably during the last 12 years. It is interesting to note, however, that although the "spread" of the figures which were accepted some years ago has recently been narrowed down, in most cases the general average figures have altered very little whenever re-analysis has been made.

In certain cases, such as the determination of silicon in cast iron, it has been found that a second evaporation does precipitate a small but significant amount of silicon, thus giving a result which is 1 or 2 per cent higher (of the Si content). A sample of red oxide iron ore analysed in 1925 showed an iron content of 58.2 per cent. The same sample remixed and re-analysed by the latest recommended methods by about a dozen experienced chemists showed 58.1 per cent. This is remarkably good agreement.

A basic slag sample, however, also analysed in 1925 showing an iron content of 8.93 per cent, was re-analysed by the same group of chemists this year. They found 8.75 per cent by the hydrogen sulphide reduction method, which is not interfered with by the presence of vanadium in the slag.

The use of British Standard methods by the co-operating analysts during more recent years has led to better agreement and this is well illustrated in the analysis of the permanent magnet alloy standard (B.C.S. No. 233).

An interesting case which occurred recently was concerned with analytical

tolerances and British Chemical Standards. The plaintiffs had bought some phosphor bronze to a stringent specification of a maximum of 0.01 per cent. The sample of the parcel had been sub-divided and sent to several analysts whose results varied appreciably.

The certificate of analyses of our B.C.S. Bronze "C" (No. 207) had been scrutinised by the defendants and it was noticed that the phosphorus content which averaged 0.055 per cent showed a range of figures varying plus or minus 0.01 per cent It was therefore explained that, with such a fine specification, a tolerance in the figures reported should bear some relationship to the tolerance shown on the B.C.S. certificate, where chemists had reported results after carefully verifying their figures. At first it was difficult for the layman to appreciate that any tolerance should be allowed, but the impartial evidence of the certificate undoubtedly impressed the judge and no doubt contributed to the defendants winning their case.

Literally hundreds of thousands of tons of steel made in this country and in Australia, South Africa, etc., have had the chemical control assisted by the regular use of British Chemical Standards—a substantial contribution to manufacturers and production.

Precise Assessment Difficult

It is difficult to assess precisely how many disputes on analysis have been avoided or settled by the use of B.C.S. but the number is certainly large. I recall that in my earlier days steel works sometimes had the analysis of their steels checked by outside independent umpires, who in some instances have very little experience in such analyses. Consequently, the results were occasionally very unfortunate. Large casts of steel were sometimes rejected and there were many heart burnings. If there had then been authoritative standard samples such as are now available, the works chemists and the management would have regarded them as priceless.

The last twelve years has been a period of steady progress during which some 27 new standard samples have been prepared and made available. In addition, a considerable number of existing standards have been renewed. The quality of the product and the agreement between chemists have likewise improved.

If I were asked what is the most important contribution these standards have made in their own field. I would say that it is that they have brought chemists all over the country into more intimate and friendly contact with one another, given them a much better knowledge of the standard of accuracy of their own work and of the methods of analysis they have been using—and most important of all—promoted a great deal of good will.

EFFLUENTS AND DETERGENTS

REFUSAL of the West Riding sewage works authorities to accept from the wool industry effluents containing synthetic detergents was commented on by Mr. W. L. Thomas, chief chemist of Woolcombers, Ltd., in an address to the Yorkshire section of the Textile Institute and the Bradford Textile Society in Bradford on 5 December.

The use of synthetic detergents in wool-scouring was now an economic proposition, for they were cheaper than soap, but bulk working, although desirable, was held up by reason of the effluent treatment problem, on which more information was urgently needed.

Objections by sewage works authorities appeared to be the result of laboratory or small-scale experiments, which indicated trouble in the biological processes of sewage treatment rather than any real difficulties. Despite the large quantities of synthetic detergents being used for domestic purposes and in laundries these did not appear to be creating insuperable difficulties in the way of sewage works generally.

The difficulties of sewage works managers and engineers in running such large undertakings as those at Bradford, Huddersfield and Halifax to public health standards were understood. With the willing assistance of the makers and users of the detergents, however, Mr. Thomas suggested that treatment could undoubtedly be modified to overcome the difficulty, for it was an impossible position that a scientific discovery of such magnitude should be permanently held up by a sewage works problem.

Referring to wool oiling—a matter of great general importance at the present time—the speaker expressed the opinion that there appeared to be no advantage to be gained by returning to the use of olive oil because of the unsatisfactory nature of the olive oil market, with its wide fluctuations in price and the fact that the source of supply was outside the Commonwealth.

FEATURES OF HARWELL'S GLEEP

First Comprehensive Report from Harwell

GLEEP, the Graphite Low Energy Experimental Pile at the Atomic Energy Research Establishment, Harwell, began operating in August, 1947. Essential features of the reactor and an account of some of the experimental work carried out is contained in the first comprehensive report which has now been released under the recent declassification of atomic information agreed upon between Britain, Canada, and the U.S.A. (THE CHEMICAL AGE, *63*, 770).

The Gleep is a slow neutron reactor using graphite as a moderator and natural uranium and uranium dioxide as fissile material. It was constructed to meet two main requirements. First, to run at as high a power as possible without elaborate cooling arrangements. This high power was needed so that radioactive isotopes could be produced until such time as the larger Harwell pile (Bepo) became divergent. Second, to compare slow neutron absorption cross-sections of the elements by the pile modulaton method.

As a later development it was found that Gleep could be used to provide an accurately known and reproducible thermal neutron flux in the range 10^6 to 10^9 n/cm²/sec. This flux can now be used to determine activation cross-sections.

The pile is built in the form of a right octagonal prism of graphite lying on one of its sides. The reacting core is cylindrical (length 5.24 m., radius 2.86 m.) with the uranium rods lying horizontally in the form of a line lattice of pitch 7¼ in.; the reflector forms the remainder of the octagon, the lower corners of which are filled in with graphite introduced for constructional reasons only.

Graphite Layers

Total quantity of graphite in the pile is 505 long tons. This is stacked in 40 layers, each of which is constructed of graphite blocks stacked in such a manner as to resemble a parquet floor. These blocks are of two standard types each measuring 7¼ in. by 7¼ in. by 29 in. Various non-standard and half blocks are incorporated, but leading dimensions of all blocks are based upon the fundamental " pitch " unit of 7¼ in. The edges of some blocks are chamfered, and grooves are cut in other blocks, so that a lattice of diamond shaped holes of 1.85 in. side runs through the pile from A (north) to B (south).

The reacting core is loaded with uranium metal up to a radius of 1.75 m., the outer region being loaded with uranium dioxide. The uranium metal is in the form of cylindrical bars 12 in. long by 0.9 in. diameter, and is sprayed with aluminium of 0.003 in. thickness to prevent the escape of recoil fission products.

In order to increase its density, the uranium dioxide is pressed into pellets 1.60 in. in diameter and 2 in. long. These pellets are wrapped in paper containers and inserted in batches of six into aluminium cans of 0.01 in. thickness. This makes a uranium dioxide cartridge 12 in. long by 1.62 in. diameter, weighing 2.6 kg. In all, the Gleep contains 12 tons of uranium dioxide.

Access to the Interior

There is a 3 ft. air space between the sides of the graphite structure and the inside of the biological shield. This allows access to the inside of the pile if the necessity arises for the removal of any of the uranium cartridges. The concrete biological shield is of 5 ft. thickness around the sides and is 4 ft. thick on the top.

On the B face of the pile there is a hole in the shield which is filled by graphite blocks to form a square section thermal column of 5 ft. wide and 7 ft. long. On the top of the pile is a large access hole so that an additional thermal column can be stacked there if it is required.

An elementary ventilation system capable of delivering 5000 c.f.m. of air is provided to remove active argon from the pile, and to provide some cooling of the uranium cartridges. The air is forced by the baffle on A face to flow over the uranium cartridges and is extracted by a suction fan on the top of the pile.

When the air system is on, it is arranged that the pressure inside the pile is always less than atmospheric; this ensures that there is no leak of radioactive air into the building. The air is ejected through a short stack on the roof of the building (the top of the stack is 60 ft. above ground level) and when the air has diffused to ground level outside the building, its activity is below the tolerance level. By using the air cooling system, the pile can be run at a power of 100 kW.

When all absorbers are removed from the pile the Gleep has an excess effective reproduction constant of 2×10^{-3}. This

excess k is controlled by four cadmium rods which move together. These four rods are known as the coarse control; there is a single rod for fine control. All the control rods can be moved up and down by electric motors which are situated on the outside of the pile and operated from the pile control room.

Emergency Control

In addition, there are two sets (each consisting of three rods) of emergency shut down rods. These cadmium rods are held right out of the pile when it is operating, by magnetic clutches. If the pile power rises above a pre-set level, a trip circuit cuts off the current to the magnetic clutches, and the emergency rods fall into the pile under gravity. On the end of a shut-down rod shaft is a disc keyed to the shaft and positioned to rotate between the poles of four electro-magnets to form an electric brake. As the rods approach the "fully in" position, the magnets of the brake are energised, and the rod motion is retarded to a gentle halt.

To indicate the position of the control rods in the pile, two transmitter magslips driven through gearing so that one rotates fifty times as fast as the other, are mounted near the drive motors. These transmitters are electrically connected to receivers in the control room, so that direct readings of the positions of the rods are given on two dials. By this means the position of the rods can be read with an accuracy of ± 1 mm.

Ionisation Chambers

The power level of the pile is measured by six ionisation chambers of 5 litres volume, containing boron trifluoride gas at a pressure of 20.7 cm.Hg. Three of these chambers are used for pile control, and the other three are used to operate the emergency shut down mechanism. All the chambers have pre-amplifiers attached to them, the main amplifiers being in the pile control room.

Initially, as the pile power is raised from zero, the resistor in series with a chamber is changed, so that the chamber measures all powers up to 1 kW without any change of position. (The resistor can be changed by operating a wafer switch outside the pile.)

Above 1 kW the chamber is wound out of the pile successively to two preset positions, in which the neutron fluxes are factors of 10 and 100 times lower than the flux at the original position.

In this way, with only three positions for each chamber, six decades of pile power can be measured. There are eight ionisation chamber holes in the pile. The two additional holes are used for experimental work; one of them is used permanently for work with the Gleep oscillator.

Rough temperature measurements are made at four points in the pile by means of resistance thermometers. Two of these thermometers are strapped on to uranium cartridges near the centre of the pile, one is embedded in a uranium dioxide cartridge, and the remaining one is embedded in a graphite cylinder which has been lowered down one of the vertical experimental holes. The temperatures are recorded continuously in the control room, and it is arranged that if the temperature of the uranium metal cartridges exceeds 60° C., the pile is automatically shut down.

Experimental Holes

Gleep has only seven experimental holes, so details of all of them are given below:

(a) Hole J_1, running from face A to face C through the centre of the pile, 3 in. diameter. Since this hole is along the axis of the pile, and therefore parallel to the uranium holes, it is used for pile oscillator work.

(b) Hole J, running from face B to face D through the centre of the pile and thermal column, 3 in. diameter.

(c) Hole K, to one side of the thermal column, running from face B to face D, 5 in. by 4 in. The maximum slow neutron flux in this hole at 100 kW is 3.0×10^{10} $n/cm^2/sec$, and this hole was used for the manufacture of radio-isotopes when Gleep first began operating.

(d) Hole Lγ, to one side of the thermal column, running from face B to face D, 8 in. by 8 in. This hole can be used for testing the effect on the reproduction constant of the pile of inserting large quantities of material.

(e) Hole W, running from top to bottom of the pile through the centre, 3 in. diameter.

(f) Holes X and Y, running from top to bottom either side of hole W, $4\frac{1}{2}$ in. diameter.

Although in the foregoing list, holes J_1, J and W are all stated to pass through the centre of the pile, they are in fact offset from each other by half of a lattice pitch.

Soon after Gleep started operating, the pile control rods were calibrated so that the amount of k they took up when in a given position in the pile was known. This was done by first of all balancing the

pile with the control rods so that it was running steadily at low power, then withdrawing the control rods a measured amount, at the same time observing the rate of rise of pile power. From a knowledge of the number of delayed neutron emitters, the half lives of these emitters and the rate of rise of pile power, it is possible to calculate the change which has been made in the effective reproduction constant.

Also shortly after starting up, a run was made at 100 kW without the air cooling system on. As the temperature of the pile rose, the control rods had to be withdrawn in order to keep the power at 100 kW. From the calibration of the control rods and the measured temperature rise, the temperature coefficient of the pile was deduced.

The temperature coefficient depends on the temperature distribution in the pile, but for a pile running without any cooling, the temperature is, of course, highest at the centre and falls off towards the edges in much the same way as the thermal neutron flux does.

For such a temperature distribution, and for the same change in the graphite temperature as in the uranium temperature at the centre of the pile, change in effective reproduction constant is: -2.9×10^{-5}/° C.

It should be noted that the pile has a negative temperature coefficient, and that this prevents the pile from rising to a very high temperature if, for example, the control system were to fail. In fact, since the excess k of Gleep is only 2×10^{-3}, a temperature coefficient of 2.9×10^{-5}/° C. means that the Gleep could ony rise 70° C. in temperature before all the excess k disappeared.

Pressure Coefficient

Pressure coefficient of the pile was measured in the following way. The pile was run steadily at low power for about half an hour, and then the control rods were set in position. Next, with all the holes in the pile shield closed as well as possible, the extractor fan was switched on. This put the pile under 3.5 cm. of water suction (the mean value as recorded by a manometer on either side of the pile), and the rise in pile power was observed for fifteen minutes.

From the rate of rise of pile power the pressure coefficient was calculated, and the answer obtained was: Change in effective reproduction constant is: -6.5×10^{-6}/mb. This coefficient is also negative, since an increase in atmospheric pressure increases the amount of nitrogen in the pile and reduces its reactivity.

In order to check that no dangerous amount of activity was escaping from the stack at high power running, a 20 atmosphere Argon chamber was installed in the top of the stack to measure the gamma reactivity of the effluent from the pile.

During the initial runs at high power, it was noticed that not only did this chamber give a higher current than would be expected from the Argon 41 activity, but also that this activity built up with time when working at a constant power level. This suggested that fission product activity was escaping from the uranium in the pile and the following experiments confirmed this.

Background Counting Rate

An aluminium tube was placed through the J hole of the pile. Arrangements were made to flow air through this tube and then over a Geiger-Müller counter. With the pile running at constant power, a given flow of air was passed through the system and the background counting rate due to the Argon 41 was determined.

A small foil of bare uranium of known area was then put into the centre of the tube and the counting rate due to the fission products carried off from the foil obtained. This bare foil was then replaced, firstly by samples of the aluminium sprayed uranium rod, and secondly by a uranium dioxide cartridge. The results of this comparison of bare uranium with the two types of cartridge used in the pile showed that whereas the aluminium spraying was 99.5 per cent efficient, the uranium dioxide cartridges were leaking gaseous fission products into the air stream at a very high rate.

In view of these results the channels of the pile containing the uranium dioxide cartridges were blocked off from the air-stream. Since they form the outside ring of the pile where the neutron flux (and therefore the heat output) is low compared with the central channels, this did not in fact make the oxide cartridges rise appreciably in temperature when running at 100 kW.

The discharge of fission products with the associated build up activity on the stack monitor was reduced by a factor of ten.

Most of the experiments described in this section were done with the Gleep oscillator.

Parliamentary Topics

FERTILISER prices were the subject of questions in the House of Commons last week, when Mr. T. Williams, Minister of Agriculture, said that it was appreciated the rise in price had caused difficulties to some farmers. Removal of the subsidy, however, had been taken into account when prices were fixed last February, and there was little chance of the general subsidy being restored. Grants in respect of fertilisers for grassland did, in fact, bring the cost of these to below 1949 level. Mr. R T. Paget asked that some credit arrangement might be made to enable farmers to spread the cost of fertilisers over the period in which they would get a return, but the Minister replied that he was not at all sure that this was necessary.

* * *

MEASURES to alleviate the shortage of some metals were being discussed internationally, stated Mr. G. R. Strauss, Minister of Supply, in a written answer. Restrictions of consumption, in some cases substantial both in amount and in their effect on industry, were already in force. Supplies of zinc to consumers were cut early in October to a rate equal to 75 per cent of consumption during the first nine months of 1950. Supplies of aluminium to consumers were limited to an amount well below current demand and nickel has been rationed by the suppliers among their customers to nine-tenths of what they had in 1949 and early 1950. Supplies of steel sheet and tinplate have been much below requirements and subject to strict allocation since the end of the war.

Fair Distribution

The Government had now decided to take further steps to ensure the proper distribution in the national interest of those metals where a severe shortage persisted. The measures under consideration in consultation with industry included restrictions on the export of semi-manufactures, the prohibition of the end uses of these metals for inessential articles, and the institution of allocation systems.

Meanwhile, the supply prospects for the metals which were at present causing most concern were as follows:—

Zinc.—Supplies of all grades of zinc available to industry over 1951 as a whole would, so far as could be seen at present, involve further cuts in consumption and out of the amount available the increasing requirements of defence would have to be met. During the first quarter of the year the position was likely to be even more serious owing to a particularly acute shortage of the ordinary grade which was used mainly for galvanising and for making brass and zinc oxide. Though every effort was being made to avoid it, the supply of this grade may have to be restricted during that quarter to little more than 50 per cent of the rate of consumption during the first nine months of 1950.

Copper.—A severe shortage of certain special shapes would affect particular fabricators, unless they were in a position to substitute the normal shapes in their processes. For the rest, the prospects for copper in the early months of 1951 were that supplies would not allow of consumption at a higher rate than in the first half of 1950, which represented a cut of about 10 per cent on the current rate of consumption and an even greater cut on normal civilian consumption as the requirements for defence progressively increased.

Aluminium.—So far as could be seen at present, supplies of virgin aluminium which have been running at about 17,000 tons a month, would have to be restricted in 1951 to 15,000 tons a month, out of which the substantially increasing demand for defence would have to be met.

Nickel.—There did not appear to be any prospect of an increase in supplies above the present level in spite of the growing demand for defence purposes.

Steel.—There was at present no real shortage of general steel but steel production in 1951 might be affected by difficulties in supplies of steel making raw materials, particularly imported scrap (mainly from Germany) and imported iron ore. It was hoped that these difficulties might be overcome but if not it seemed possible that the 1950 level of steel output might not be achieved in 1951. No improvement in supplies of steel sheet or tinplate could be expected until the new plant in South Wales came into production in the latter part of 1951.

It was obvious that if shortages of non-ferrous metals of the kind continued throughout 1951, they could not but impose a serious check upon the rising output of the engineering industries on which we were so heavily dependent not only for our rearmament programme but also for a large part of our export trade and for essential investment at home.

Steps would, of course, be taken to ensure that these metals were available for rearmament.

MR. FREDERICK PEEL

It is with the greatest regret that we announce that MR. FREDERICK PEEL died suddenly at his home at Upminster on Wednesday, 6 December, in his 64th year.

Mr. Peel was born on January 21, 1887, and received his technical education at the Marine School, South Shields, and Sunderland Technical College. He served an apprenticeship of six years in the Mercantile Marine, rising to chief engineer. He then served three years in the shipbuilding and engineering shops of John Readhead & Sons, South Shields, and was Premier Silver Medallist in Mechanical Engineering, City and Guilds Institute, Premier Prizeman of Goldsmiths Institute, and National Prizeman in Machine Design, Board of Education. He obtained the Extra First Class Engineers Certificate under the Board of Trade.

For three years he was with Messrs. John I. Thornycroft & Co., Ltd., and Messrs. Job Bros., Liverpool, engaged on the design, construction, testing, and installation of large two-cycle marine diesel engines at a time when this was work of a very pioneering nature.

In 1913 he began to work with W. J. Fraser & Co., Ltd., at Dagenham, on the design and construction of a revolutionary type of two-cycle diesel engine, the main features of which have become standard practice in marine engines of this class. Work on this was suspended because of war conditions in 1915, when Mr. Peel became chief draughtsman and subsequently chief engineer of W. J. Fraser & Co., Ltd.

He took up the study of chemical engineering and the design of chemical equipment in a very energetic manner and was associated with many advances in acid, fertilizer, mineral oil and many other types of chemical plant. He was appointed a director of the company in 1938.

During the last few years. Mr. Peel devoted a large proportion of his spare time to work on the preparation of the Standard Code of Practice for the Design and Construction of Pressure Vessels for the British Standards Institution, this work culminating in the issue of B.S. 1500 and its accompanying material specifications. He was a member of the Main Committee on Pressure Vessels and of all its panels and he personally drafted many sections of the Code.

Mr. Peel was one of the earliest members of the Institution of Chemical Engineers and was a member of the Institute of Marine Engineers.

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Harrison Memorial Prize

The Harrison Memorial Prize for 1950 is to be awarded to Dr. Hugh Christopher Longuet-Higgins. The presentation of the prize will be made during the anniversary meetings of the Chemical Society to be held in London on 20 and 21 March, 1951. This decision was reached at a meeting of the Selection Committee held on 7 December.

Dr. Longuet-Higgins was educated at Winchester and at Balliol College, Oxford, where he was an Open Scholar. He was awarded first-class honours in the final honour school of natural science (chemistry) in 1945. During the years 1945-8 he worked under Dr. (now Professor) C. A. Coulson. In 1946 he was elected to a junior research fellowship at Balliol College, but relinquished this in 1948 to become a research associate of the University of Chicago, where he carried out experimental and theoretical work with Professor R. S. Mulliken and Dr. W. C. Price. In 1949 he returned to become lecturer in theoretical chemistry at the University of Manchester.

The Harrison Memorial Prize may be awarded for outstanding merit in any branch of pure or applied chemistry. It was created in 1922 to commemorate the devoted services of the late Colonel E. F. Harrison, formerly deputy controller of the chemical warfare department, for the protection of the British forces from poison gas in the 1914-1918 War. It is awarded to the British chemist, under 30 years of age, who, during the previous five years has published the most meritorious and promising original investigations in chemistry.

Atom Scientists Meet

MORE than 200 nuclear scientists from Great Britain, the U.S.A., Europe and India are now meeting in Bombay. The occasion is the International Conference on Elementary Particles, which will last until December 21. The scientists will discuss, among other things, cosmic rays and the meson, and will also review recent experimental evidence for the interactions and transformations of fundamental particles, as postulated by theoretical and mathematical description. The conference will be inaugurated by Professor Niels Bohr.

POWDER METALLURGY

IN a recent lecture to members of the American Society of Metals, Dr. Henry H. Hausner said that powder metallurgy methods for research included four basic applications of the relatively new technique which might be defined as: (1) for investigations which exclude molten stage of the metal, (2) when interruptions are required to investigate certain stages of the process, (3) when statistical observations are desired, and (4) when high pressures between small surfaces are used for investigations.

The development of powder metallurgy techniques was greatly accelerated in industry during World War II, he said, when it was urgent to produce metal parts with maximum speed, a minimum of manpower and, in many instances, with special materials. Powder metallurgy was the technique for production of solid metal parts from metal powders by compacting and sintering below the melting point of the metal. This method could be applied to production of parts made of one metal or made of alloys.

Tracing the development of powder metallurgy from its first commercial application Dr. Hausner said it reached back to the work of Auer von Welsbach who used a similar technique for the development of cerium wire for incandescent lamps in 1897. Dr. Coolidge, of General Electric, applied the technique to produce the first ductile tungsten wire for incandescent lamp filaments in 1909, and the rapid progress since that time in both lamp and radio tube development was closely connected with powder metallurgy production of tungsten and molybdenum.

Used for Making Contacts

Powder metallurgy methods were also widely used in the production of electrical contacts which must not weld or stick during operation, should be hard and not pit and should have good electrical and heat conductivity. Powder metallurgy permitted compounding metals which tend to combine the good conductivity of the silver-copper group with other desirable characteristics of the tungsten-molybdenum group.

Applications where the physical properties of products resulting from powder metallurgy techniques were important, included a wide range of items such as metallic filters and porous or oil-impregnated bearings and bushings, not necessarily of small dimensions. The Chrysler Corporation, General Motors, Ford and other automobile manufacturers were large consumers of powder metallurgy parts including those for windshields, generators, heat blowers, valve guides, shock absorbers, oil pump rotors and many others.

During the last few years, another application of powder metallurgy methods had been developed. Experience and theoretical considerations had shown that powder metallurgy could be usefully applied for research in general physical metallurgy, in the study of phenomena such as nucleation, recrystallisation, grain growth, diffusion and homogenisation. Powder metallurgy of today was a research tool, the usefulness of which could hardly be over-rated.

Sulphuric Acid Production

REDUCTION of imports of sulphur from the U.S.A. could be faced with fortitude stated Mr. F. A. Perkins, chairman and managing director of the Lawes Chemical Company, in his address to the 78th annual general meeting in London on 5 December, as some two years ago the erection had been approved of a plant to produce sulphuric acid from sulphur bearing materials other than those from American sources.

Progress payments on the acid plant at 30 June, amounted to £74,000, and although some delays inherent in a scheme of construction had been experienced, progress was sufficiently satisfactory for some advantage to be gained during the current season.

Demand for granular compounds had risen, continued the chairman. An increase in stock reserves made in May and June might have some effect upon the 1950-51 season, but once the sulphuric acid plant came into operation, greater production would be possible.

The company's Articles of Association which were nearly 50 years old had been brought up to date to comply with the Companies Act, 1948.

Considerable attention has been drawn recently to productivity of British industry. It was satisfactory to note, therefore, that in the Anglo-American Productivity report British granular plants had produced figures comparable with the best American practice. Compound fertiliser production in 1949-50 was approximately three times that of 1939-40. This company had played its full part in this increase.

The necessity to expand production of food at home was recognised by the Government and fertilisers were essential to this end for any programme. Close co-operation with Government departments had been maintained.

SULPHUR — THE AMERICAN PICTURE

From a Correspondent

The sudden crisis in sulphur supplies and its consequent effects upon sulphuric acid output have been discussed in recent issues of THE CHEMICAL AGE, *particularly in the issues dated October 21 (pp. 557-558) and December 2 (p. 767). The following article, based upon American information, is particularly relevant as almost all Britain's sulphur requirements were until recently imported from the United States.*

THE standard text-books used by many present-day chemists when they were being trained laid the main emphasis upon Italy, and particularly Sicily, as the world's principal source of elemental sulphur. The fact that almost the whole of Britain's sulphur needs since the war have been imported from America has surprised some chemists whose only contact with this element is with the sulphuric acid made from it. The virtual cessation of sulphur exports from the U.S. has led to a crisis for the British chemical industry, the seriousness of which would be hard to exaggerate. The production of materials for which large quantities of sulphuric acid are required has been curtailed, *e.g.*, superphosphate. The prices of innumerable chemicals whose manufacture requires sulphuric acid will have to rise.

The development of a large sulphur industry in the United States began just before the first world war. In the previous century much of the sulphur required for sulphuric acid manufacture was imported from Italy but from about 1890 onwards the high price required drove more and more of the U.S. acid manufacturers to the alternative method of pyrites burning.

War Requirements

In the first world war the total demand for acid rose so greatly that the use of sulphur returned and by the end of the war nearly half of America's sulphuric acid was being produced directly from sulphur. At the same time, however, a new process for extracting sulphur from salt domes in Louisiana had been developed by Herman Frasch; indeed, even as early as 1913 250,000 tons of sulphur were being produced from Louisiana compared with 400,000 tons from Sicily.

The Frasch process is simple and cheap. The sulphur deposits occur at depths of about 900 feet beneath clay, sand, and rock. Pipes are sunk through a bore-hole and super-heated steam is pumped down some pipes. This fuses the sulphur. Compressed air is pumped down other pipes and an aerated emulsion of molten sulphur rises to the surface through the remaining pipes. The emulsion solidifies on cooling in tanks and sulphur of high purity is immediately available.

The low costs of this process for extracting sulphur from natural deposits not only encouraged the American acid industry to develop sulphur-using rather than pyrites-burning plant, but it reduced the world price for sulphur, which had remained high so long as Italian deposits produced the dominant share of the world's total output of the element.

Competition

Competition brought lower prices and the tendency to base acid manufacture upon such materials as pyrites, native to many countries, was checked. In a recent American article[1] it was said that the Frasch process "restored brimstone sulphur to its premier position as the source of world sulphur in the manufacture of sulphuric acid."

By 1920-1924, 800,000 tons of sulphur per year were being extracted from salt domes in Louisiana. Today the annual rate of extraction is 5 million tons. Unhappily there is every sign that the contribution of the Frasch process to the world's sulphur needs will come to an end when it is between fifty and sixty years old.

In 1944 the remaining reserves were estimated by the Bureau of Mines and the U.S. Geological Survey to be 82 million tons. By the end of 1950, 25 million tons will have been extracted. The residue of 57 million tons will last only another 11 years at the present rate of mining, 5 million tons per year. Some authorities in the United States believe that the 1944 estimate was somewhat conservative but even their more optimistic verdict is that Louisiana and Texas salt domes cannot continue to yield sulphur longer than another 15 to 20 years.

The Frasch process, though cheap to operate, has severe limitations. The sulphur-containing salt domes of America lie on the Mexican Gulf coast between the Rio Grande Valley and Alabama. In all nearly 200 domes have been found but only 12 have been workable. The Frasch method can be applied only to domes that meet precise geophysical conditions. Also, the extraction method mines only a small area.

Even now when 5 million tons a year are being produced, only seven domes are being worked. The remaining five of the 12 in the history of this process have already been abandoned. One of the seven currently operated is said to yield two-thirds of the total sulphur produced, or about twice as much as the other domes together.

The Gulf Coast region has been thoroughly explored for both oil and sulphur and it is now felt that new deposits are unlikely to be discovered there. Domes are known to exist beneath the sea in the Gulf of Mexico, but the cost of underwater installation of the Frasch process would make sulphur extraction hopelessly uneconomic.

Exhaustion By 1970

Within the United States sulphur deposits minable by the low-cost Frasch method will be exhausted by 1970 at the latest and probably some years before. The only hope for any continuation of this process seems to lie in Mexico where a number of sulphur-containing salt domes have already been prospected.

These deposits are a long way from industrial centres and communications would have to pass through jungle areas but useful tonnages of sulphur are believed to be producible. No developments of any size have yet taken place.

With the post-Korean re-armament programme increasing the demand for many products requiring sulphur and acid, an appreciable number of dearer sulphur sources is certain to enter production. In the past the low price of Frasch sulphur has discouraged these alternative processes. Another effect that is already disturbingly realised in Britain is that America has decided to reduce sulphur exports drastically.

Sulphuric acid can be produced without using elementary sulphur. Indeed, pyrites and brimstone sulphur have been competitive raw materials for many years. The movement away from sulphur towards pyrites in America at the end of the last century began when Italian sulphur rose from 20 to 70 dollars per ton; it is not uninteresting to compare the recently advanced price to 22 dollars per ton. Making allowance for the reduced value of all currencies since the turn of the centuries, this comparison shows how greatly sulphur prices have been reduced by the Frasch process.

With a free choice, most acid manufacturers today would prefer to use elementary sulphur. The total cost of a pyrites roosting plant is 2½ times that of a sulphur burning plant. The labour and maintenance costs are much higher; total operating costs are said to be five times higher. One appreciable factor is that pyrites contains much less sulphur per ton; 40 per cent as against 98 per cent of the material burnt produces sulphur dioxide. The residual iron oxide is not an immediately valuable by-product; it must be further processed before it is suitable for the steel industry.

Nevertheless, even in America a steady return to pyrites as a source of sulphuric acid is now likely to develop. Known American reserves of iron pyrites are sufficient to last for 25 years and further deposits could almost certainly be discovered. For American users of acid this must mean appreciably dearer acid. It is unlikely, therefore, that opinion in America will favour a revival of substantial exporting of cheap sulphur to countries which formerly relied upon American sulphur. As the price of acid in America steadily rises the chances of reviving sulphur exports will become less and less.

There are a number of deposits of sulphur besides the salt dome deposits, but it is unlikely that these will produce cheap sulphur. Even with relatively cheap labour available the large Italian deposits have long failed to compete with Frasch-obtained sulphur. It is felt in America, therefore, that surface deposits in Texas, Utah, and California will be more costly providers of sulphur for acid than pyrites.

Still Plenty of Sulphur

This, then, is the background to the present situation. To talk of an approaching world shortage of sulphur is incorrect. There is plenty of sulphur—in pyrites deposits and in mineral sulphate deposits. Appreciable amounts of elementary sulphur are still left in the surface deposits of the world workable by normal mining methods.

What has happened is that the one source of low-cost sulphur has come within sight of eventual exhaustion; and the effects of this have been sharply accentuated by rearmament and an enlarged demand for sulphuric acid. All the alternative methods of making acid or producing sulphur are inevitably more costly; widespread increases in costs in the chemical industry would seem to be inescapable.

[1] V. Sauchelli, *Soil Science*, 1950, 70, 1, pp. 1–8.

[2] *Chemical Industries*, 1950, 67, 5, pp. 718–719.

TESTING VULCANISED RUBBER

STANDARDISED methods of analysis and tests for vulcanised rubber were first issued as B.S. 903 by the British Standards Institution, in 1940. A revision of that document has now been issued both for the purpose of providing methods for use in British Standards and to provide a set of reliable methods for use by all those concerned with the analysis and testing of vulcanised rubber.

It is pointed out that in addition to a great number of tests which are now in general use having been added to the original standard, the scope of the document has been widened to cover synthetic rubbers as well as natural rubber.

The standard does not include all the test procedures for which standardisation is desirable, because some require further investigation before reliable standard techniques can be recommended. In view, however, of the urgent need for a revision of B.S. 903, to meet the demands of rubber manufacturers and users, it has been thought best to defer inclusion of these still debatable procedures until they have been further studied.

The document has been drawn up in such a way that closely related methods are grouped into a self-contained document and are given a distinctive number.

The various methods of analysis and tests covered by the standard are as follows:—

Acetone extract, unsaponifiable matter in acetone extract, paraffin wax and ceresin, chloroform extract, alcoholic-potash extract, total sulphur, extractable sulphur, rubber-combined sulphur, sulphur in total fillers, sulphide sulphur, natural rubber hydrocarbon (direct determination), nitrogen (for acrylonitrile polymers), chlorine (for chloroprene polymers and copolymers), isobutene-diene (butyl rubber), thioplast rubbers, total fillers, ash, carbon black, antimony, copper manganese, carbonate, glue, cellulose, water extract.

Physical Testing Methods

Methods for physical testing for the following are included:—

Accelerated ageing, density and specific gravity, tension stress-strain, tension set, compression stress-strain, compression set, hardness, durometer indentation, creep and tress relaxation, rebound resilience, resistance to low temperature, abrasion resistance, tear strength, resistance to flex-cracking and cut-growth, swelling in liquids, equilibrium water vapour absorption, permeability and porosity to gases, permeability to liquids, ply separation (adhesion), electric strength, surface and volume resistivity, permittivity and power factor, and for ebonite, the following:—

Cross-breaking strength, impact strength, plastic yield, compression strength, linear coefficient of thermal expansion.

Sir John Cass College

AN interesting series of courses is announced by the Sir John Cass College for the second term of the 1950-51 session.

In the department of chemistry, ten lecture-demonstrations will be given by David W. Wilson, M.Sc. (Belfast), F.R.I.C., and Joy P. Stern, B.Sc., Ph.D. (London), D.I.C., A.R.C.S., A.R.I.C., on "Microchemical Analysis." The course is suitable for analysts and advanced students and is designed to introduce the principles and technique of inorganic and organic analysis on the micro and semi-micro scales. The series which will be given on Thursday evenings, begins on 11 January.

"Distillation" is the subject of a course of eight lectures to be given by G. A. Dummett, M.A., A.M.I.Chem.E., on Friday evenings, beginning on 12 January.

A continuation of the former series of lectures on radioactivity will be given in a series of six lectures and demonstrations on "Radiochemical Methods of Analysis," commencing on Tuesday, 16 January. The three speakers will be A. A. Smales, B.Sc., A.R.I.C. (Atomic Energy Research Establishment, Harwell), D. A. Lambie, B.Sc., A.R.I.C. (Radiochemical Centre, Amersham) and J. E. Page, B.Sc., Ph.D., F.R.I.C. (Research Division, Glaxo Laboratories, Ltd.)

In the physics department a special course of 10 lectures will be given on "X-Ray Crystallography," by L. A. Thomas, B.Sc., F.Inst.P. (Research Laboratories of the G.E.C.), beginning on 4 January. The lectures, to be held on Thursday evenings, will deal with the principles and methods of X-ray analysis.

Other courses announced include seven lectures on "Petroleum Refinery Practice," beginning on 11 January under the chairmanship of R. B. Southall; and a laboratory course on "Solid Fuel Analysis," by L. J. Edgcombe, B.Sc., A.R.I.C., on Monday evenings from 8 January.

FREE NITROGEN

FOR some time it has been maintained that organisms within the soil are able to capture free nitrogen from the air. Although this has been disputed from time to time, so much weighty evidence has been offered to support the theory that it is now generally accepted as fact. Leibig went even further, and argued that the parts of plants above ground were also able to make use of the free nitrogen from the air. This became the subject of a fierce controversy between Leibig and Lawes until these later theories were discredited.

It has always seemed possible that nitrogen should be captured either during respiration or by direct absorption, and also that other chemicals in extreme dilution might be absorbed as well. For example, by merely spraying the foliage of certain crops with extremely weak solutions of metallic salts, it has been found possible to remedy trace element deficiencies.

Nitrogen, however, is the staff of plant life, and if it were possible to prove that the vegetative cover is continually taking nitrogen from the air, then some important knowledge would have been gained. The next step would then be to discover which type of plant growth captured most nitrogen, and how the rate of absorption could be increased.

South African Theory

A paper on "Soil Science" which merits attention has recently been published by Ingham, a South African chemist. He believes that soils are continually being supplied with appreciable quantities of nitrogen from the atmosphere because of the earth's vegetative cover. He suggests that, because of their colloidal nature, cellulosic substances are able rapidly to adsorb minute particles from aerosols. Ingham presents the theory of a continual and regular process whereby nitrogen is adsorbed, and then washed out by rain, so that the cellulosic substances can then adsorb further quantities. Meanwhile the nitrogen passes with the rain into the soil.

The author sets out to prove that, besides ammoniacal and nitrate nitrogen, other nutrients, such as lime and phosphorus, may also be adsorbed. He advances the theory that this constant adsorption of plant food collected by the organic matter above the soil, including tree foliage, may be of greater accumulative significance than the fixation of nitrogen by soil bacteria.

Ingham's views find ample support in clear evidence provided by delicate chemical analyses which were unknown during Leibig's lifetime. This provides a reason for Leibig's inability to refute the arguments of Lawes, and the fact that this important discovery has been delayed for so long.

According to Ingham, the rate of ammonia adsorption is trebled if cellulose is first washed with dilute acid. The cellulose can then adsorb more than 100 p.p.m. of ammoniacal nitrogen in a few days, though falling rain collects only about 0.5 p.p.m. of this nutrient. Cellulosic material, such as dried grass, wood and jute fibres, are said to have the same adsorptive properties.

Powell Duffryn Directors

THE board of Powell Duffryn Technical Services Limited announces that MR. A. L. G. DAVIES, M.I.Min.E., M.I.M.E.E. and DR. A. A. J. K. ESKREISS, Ph.D., Dr.Eng., have been appointed directors of the company. MR. J. G. BENNETT has resigned from the board.

Dr. Eskreiss, a chemical engineer of international repute, is a senior member of the staff of Powell Duffryn Technical Services Ltd., and is responsible for the direction of the synthetic fuels and chemical engineering division of the company. He has wide experience in designing, direction and operation of chemical plans in Great Britain and on the Continent. During the war he was a senior member of the staff of Imperial Chemical Industries Ltd., and afterwards was attached to the chemical branch of the Allied Control Commission in Germany where he was responsible for the rehabilitation of two Fischer-Tropsch plants in the Ruhr area. He has made an exhaustive study of the coal-to-oil conversion processes in the United Kingdom, Germany and the U.S.A.

Mr. Davies is a leading ventilation engineer and has had over 30 years' service with Powell Duffryn.

MR. JAMES B. MORGAN has joined the board of Wilfred Smith, Ltd., London. Mr. Morgan who has been with the company for over 25 years is also a director of its associate firm Fincham and Smith, Ltd.

Chemical Society Library

It is announced that the library of the Chemical Society will close for the Christmas holidays at 1 p.m. on Friday, 22 December and be re-opened at 10 a.m. on Thursday, 28 December.

TRIETHYL ORTHOFORMATE

TRIETHYL ORTHOFORMATE closely resembles acetal in many of its properties. It is stable in the presence of alkalis but unstable in the presence of acids. The ester is a volatile liquid possessing a pungent smell and having a boiling point of 145.9°C. at 760 mm. It is soluble in alcohol and ether and appreciably soluble in water. The specific gravity of triethyl orthoformate is 0.895 at 20°C. and the weight per gallon at this temperature 7.47 lb.

In common with normal esters, triethyl orthoformate undergoes ester exchange—e.g. when reacted with an alcohol in the presence of a catalyst trialkyl or triaralkyl orthoformate is formed. Another typical reaction is the formation of acetals or ketals, e.g. with grignard compounds the acetal of the aldehyde, which contains the organic residue present in the Grignard is given: acetals or ketals are formed with some carbonyl compounds in the presence of a catalyst. Of importance is the use of triethyl orthoformate as a source for the ethoxymethylene group, e.g. the reaction involving triethyl orthoformate and diethyl malonate in the presence of acetic anhydride gives alpha-ethoxy methylene malonic diethyl ester.

Using triethyl orthoformate as a raw material for making synthetic resins du Pont chemists have developed several interesting polymers. U.S. Patent 2,402,137 and Brit. Pat. 583,181 disclose a method of making resinous bodies called telomers by reacting the ester with ethylene gas under pressure.

$$C_2H_5 + HC(OC_2H_5)_3$$
$$H(CH_2CH_2)_n\ C(OC_2H_5)_3$$

The telomer is claimed to possess wax-like properties which qualify it for use as a wax substitute.

Another du Pont patent (Brit. Pat. 547,854) describes the reaction of triethyl orthoformate with beta gamma unsaturated alcohols (boiling above triethyl orthoformate) in the presence of esterification catalyst, to form unsaturated ortho esters, which may be polymerized to form useful resins. Interesting possibilities are opened up in the production of new plasticizers from the orthoformate and some of the trialkyl or triaralkyl orthoformates appear to offer some possibilities for the cellulosics.

Pakistan Paint Industry

The Pakistan Tariff Commission has decided that a *prima-facie* case exists for a full inquiry into the paints and varnishes industry.

PAPER CHROMATOGRAPH METHODS

A JOINT meeting of the Society of Public Analysts & Other Analytical Chemists and the Food Group of the Society of Chemical Industry, was held in the Meeting Room of the Chemical Society, Burlington House, London, on Wednesday, December 6. The president, Mr. George Taylor, O.B.E., F.R.I.C., having opened the proceedings, invited Mr. A. L. Bacharach, M.A., F.R.I.C., chairman of the Food Group, to occupy the chair for the remainder of the meeting.

Rapid Separations Possible

In their paper—"Applications of Paper Chromatographic Methods in the Sugar Industry"—H. C. S. de Whalley, F.R.I.C., M.I.Chem.E., N. Albon, B.Sc., A.R.I.C., and D. Gross, Dip.Ing., Ph.D., explained that separation of sugars of interest to the sugar industry could be made rapidly and quantitatively by the procedure used by Dr. S. M. Partridge, of the Low Temperature Research Station, whose advice and assistance at the beginning paved the way for the later investigations.

Heat degradation products of fructose, the more labile reducing sugar, were separated and, by co-operation with F. W. Zerban and L. Sattler, were found to be identical with the non-fermentables of cane molasses. Some "compounds" were shown to be mixtures.

By paper chromatography, raffinose in raw beet sugar could be estimated with precision and certainty for the first time. The degree of purity of sugars such as raffinose had been determined. Freedom from traces of sucrose could previously only be inferred, as the exact physical constants of the sugar were open to conjecture.

Mixtures of starch hydrolysis products, such as those present in beer, could be separated and identified quantitatively.

The Lobry de Bruyn conversion could be demonstrated by means of paper chromatography, to show the equilibrium concentrations of glucose, fructose and mannose and also the presence of another sugar, allulose.

At intermediate stages of sucrose inversion by invertase the appearance of at least one synthesised tri-saccharide had been noticed.

Chromatographic methods made examination of the organic and inorganic non-sugars, including colouring matters, a relatively simple matter, but much further investigation into the identification of the separated products was required.

The Chemist's Bookshelf

UNFAMILIAR OXIDATION STATES AND THEIR STABILISATION. Jacob Kleinberg. 1950, Lawrence, Kansas: The University of Kansas Press. Pp. viii + 131. Figs. 8. $3.

This is a short work of about 30,000 words, and consists of a series of short monographs on related topics in inorganic chemistry with which the ordinary chemist is perhaps not so familiar as he might be or as he ought to be.

Unfamiliar oxidation states have many aspects of importance at the present time, both from theoretical and practical points of view. Thus, on the one hand study of lower oxidation states of elements such as gallium and indium, and relation of the observations to the known behaviour of thallium and the suspected behaviour of aluminium, is of importance in any comprehensive study of the periodic properties of the elements.

From a quite different viewpoint, the less common valencies of 2 and 4 in the lanthanons has proved of the utmost importance in certain separations of these intractable elements. Again, iodine and the artificial element astatine (85) which completes the halogen group show a most interesting series of analogous behaviour. These help to explain the tendency of iodine to exist in unusual valency forms hitherto regarded as somewhat anomalous. Finally, stabilised complexes in which the central element is present in a normally unstable valence form may be of importance in modern analytical procedures.

All these unfamiliar valency states provoke interest, and Dr. Kleinberg has done chemists a service in presenting within one cover a unified account of the more important of them. The principal elements dealt with are the aluminium group, oxygen, the halogens, copper and silver, chromium and manganese, iron, cobalt and nickel, and the lanthanons. Undoubtedly one could supplement this list by the names of other elements which might be considered worthy of inclusion, but the author claims to have dealt only with those cases which he himself has found most interesting.

It is commendable that a serious effort has been made to present the material critically, so that while the treatment of each element is full and accompanied by a comprehensive literature survey, some form of conclusion is reached or suggested in those cases where controversy still exists. That the reader may not always agree with the conclusion should not be taken as any implied criticism of the author's treatment, but merely as an indication that in certain cases there is clearly a need for further investigation.

This book should have a ready sale both to students and to research workers who have to deal with any element which has actual or potential variable valency—this rightly implies practically every worker in the inorganic field. The bearing of the book extends far beyond the catalogue of elements specifically discussed within its covers. If nothing else, it serves to emphasise certain aspects of inorganic chemistry which are scarcely dealt with in the average general textbook.

This book has one or two minor blemishes, the lack of an author index, for example, and the mild inconvenience found in consulting the references, which are not readily identified without first ascertaining the number of the chapter which one is reading.—C.L.W.

Promacetin for Leprosy

Successful treatment of leprosy is claimed for promacetin, a new drug developed in the U.S.A. A white crystalline compound, taken by the mouth, promacetin is said to bring quicker relief with fewer adverse reactions than other leprosy drugs.

Confused Identities

In the report of the dinner to mark the centenary of Hopkin and Williams, Ltd. (THE CHEMICAL AGE, 63, 771), a toast in honour of the company was stated to have been proposed by Dr. L. H. Lampitt. The toast in question was actually proposed by Professor R. P. Linstead, professor of organic chemistry, and director of the organic chemistry laboratories, Imperial College of Science and Technology.

We regret any embarrassment this inaccuracy might have caused.

OVERSEAS

Colombian Fertilisers and Asbestos

A six million peso enterprise to produce ammonia for the manufacture of chemical fertilisers is shortly to be set up by the Caja de Credit. Agrario y Minero, the National Coffee Federation and the Instituto de Fomento Industrial. The last-named also proposes to exploit large asbestos deposits existing in various parts of the Department of Antioquia.

Chemical Progress in Hungary

Satisfactory development of the chemical industry is reported from Hungary. Production in the first half of this year is estimated to be nearly 50 per cent greater than in 1949. Manufacture of aniline dyes is now said to be sufficient not only for home consumption but also for export. Exports which include metallic oxides, industrial acids, gelatin, and industrial alcohol have trebled the 1949 figure.

To Publish History

The Mallinckrodt Chemical Works of St. Louis, Missouri, is shortly to publish an outline of chemistry, which is expected to have a permanent value for chemists and teachers. The work begins with the pre-Christian origins of chemistry in India, China and Egypt and traces the evolution of chemistry up to the present time.

New Roasting Process

What is described as "a revolutionary" roasting process for the concentration of arsenical gold ore from the quartz reef was demonstrated to metallurgists and mining men at Industria, Johannesburg, on 29 November. The pilot plant, which is a flash oxidiser, is said to roast sulphides in the refractory ores without any of the disadvantages of the orthodox furnaces.

A New Silicone Rubber

The chemical department of the (U.S.) General Electric Company at Pittsfield, Massachusetts, has developed a new silicone rubber compound said to permit rubber fabricators to mould more readily silicone rubber with highly improved mechanical and thermal properties. Many parts can be fabricated from the new 81223 compound without prolonged oven cure, and it is said to have excellent moulding and extrusion properties after only five minutes' heating.

New applications for silicone rubber mechanical goods, including diaphragms, sleeves, belting, hose and mountings, are expected to evolve from the new compound.

Canadian Ammonia Plant

Dow Chemical of Canada, Ltd., will build a plant in Sarnia, Ontario, to produce anhydrous ammonia. Contract for the construction of the new plant has been awarded to the Austin Co., Ltd., and construction will start immediately.

The plant will, to a large extent, be similar to facilities that currently are operated by the Dow Chemical Co. at Midland, Michigan, and Freeport, Texas. The engineering for the project is being handled jointly by the Sarnia and Midland engineering departments. Total cost of the plant will be somewhat more than $1 million (roughly £333,333).

The principal raw material to be used is hydrogen, which is now being produced in the Dow chlorine-caustic plant at Sarnia. The new plant will combine this hydrogen with nitrogen from the air, under high pressures, to produce ammonia. Designed capacity of the plant is 15 tons of ammonia per day and provisions are being made to permit rapid expansion if this is found to be desirable. At the present time ammonia is produced by several other companies in Canada, principally in Alberta, British Columbia and Ontario.

Influence Felt

The impact of allocations imposed by suppliers on chemicals in the United States during recent weeks because of defence orders is beginning to be felt in Canada. These allocations are based on consumption during the current year.

Most notable of these imports is methanol, which is a raw material for jet fuels, formaldehyde, resins, bakelite and some plastics. The United States is still recovering from the widespread strikes which hit alkali producers earlier this summer. These strikes have created a large back-order position in the glass industry because of soda ash shortages and numerous chlorinated organics because of the lack of chlorine. In Canada chlorine has been tight and has affected the supply of chlorinated solvents. Most notable are perchlorethylene, trichlorethylene and carbon tetrachloride.

Chemical prices are continuing to rise both in basic chemicals and further manufactured items. Price increases of process chemicals announced during recent months are now showing their effect in such items as paper, rubber, textiles and numerous other commodities.

HOME

Byproducts from New Coke Ovens

Two new batteries of coke ovens at the East Greenwich works of the South Eastern Gas Board were opened on December 7 by the Duke of Gloucester. The new coke oven plant will carbonise about 1000 tons of coal every day, producing 13.5 million ft. of gas. Byproducts per day will be: 700 tons of coke, 25,000 lb. of ammonia, 10,000 lb. of sulphur, 3000 gallons of benzol, and 10,000 gallons of tar.

Non-Ferrous Metals for Britain

A total of 5400 tons of non-ferrous metals were scheduled to arrive in Britain last week. The shipments, due from the U.S.A. and Canada under the Marshall Plan supply programme, include the following items (in tons): aluminium ingots 2400; zinc, 1330; lead, 850; copper 820. Other Marshall Aid cargoes expected in London include 384 tons of steel and over 300 tons of carbon black.

Cosmic Rays Underground

Research into the penetrating powers of cosmic rays from the upper atmosphere is being carried out by two scientists at Holborn and Arsenal underground railway stations. The work is intended to supplement that at present being carried out by means of cloud chambers and magnetic deflecting instruments and by high altitude research.

To Perpetuate Memory

In the Council room of the Pharmaceutical Society after this month's meeting on 6 December, the president, Mr. Adam Meldrum, accepted an oil painting of Mr. A. R. Melhuish, president in 1930-2, who died last April at the age of eighty. The painting was unveiled by Mrs. Melhuish who was presented with a photograph of it by Mr. R. Woolby Brooke, chairman of the Western Branch of the Society of which Mr. Melhuish was a prominent member for many years, and which was responsible for having the painting executed. Mr. Melhuish, said Mr. Meldrum, had attended council meetings in that room for more than thirty years, a period which few members of the council could have exceeded throughout the Society's history. They realised how fitting it was that he should be looking over the scene of so many years of labour in the interests of pharmacy. His portrait would help to keep green the memory of one who had a special claim to be remembered for both what he was and what he did.

Record Steel Output

The highest figure ever achieved in steel production was attained in November, output reaching an annual rate of 17.472 million tons. The previous record rate of 17.147 million tons a year was established in March this year. At the present rate of production it seems probable that the total for 1950 should reach about 16.4 million tons compared with the target of 15.75 to 16 million estimated in the Economic Survey.

U.K. Solvent Separation Plant

The only solvent separation plant of its kind to be found outside the United States has been brought into operation by Price's (Bromborough), Ltd. The plant is used for the separation of solid and fatty acids in the manufacture of stearines and oleines. Stearines are used in the manufacture of cosmetics, tooth pastes, and shaving soaps and creams, and oleines for oiling raw wool, as a textile oil in artificial silk manufacture and in the manufacture of dyestuffs, stencils, carbon papers, printing inks, metal and boot polishes, insecticides, lubricating oils and paints. The firm itself produces only the fatty acids and oils used by industries in this country and abroad, including the U.S. and Canada, in the manufacture of a great variety of products. The plant is in an entirely new building erected and equipped at a cost of between £300,000 and £400,000. The company, of which Mr. W. F. Darke is chairman, make a considerable contribution to the export trade of Great Britain.

Census Arrangements

An Order indicating the scope of the Census of Production to be taken in 1951 in relation to the year 1950 has been made by the Board of Trade. Undertakings producing coal, gas, electricity, oil shale, crude or refined petroleum or shale oil products are exempted from making Census of Production returns to the extent to which they supply the necessary information to the Minister of Fuel and Power.

The title of the Order, which operates from 30 December 1950, is "The Census of Production (1951) (Scope, Returns and Exempted Persons) Order, 1950." Copies may be obtained from His Majesty's Stationery Office or on order through any bookseller.

The Stock and Chemical Markets

THERE has been a steadier tendency in stock markets this week, although at the outset very little improvement in the volume of business was reported, caution prevailing prior to the Prime Minister's statement on his talks with President Truman. Apart from the vital questions of foreign affairs, there is anxiety as to supplies of essential materials, prices of which are rising owing to world rearmament. Because of rearmament requirements it is clear that there may have to be very drastic rationing for industry, unless the U.S. makes larger supplies of base metals and other commodities available to Britain. Until the raw materials position becomes clearer it will be very difficult to estimate prospects. Meanwhile, attention may centre mainly on rearmament shares and those of export trade companies.

Chemical and kindred shares are at present tending to attract rather more attention, because of the importance of the chemical industry both in rearmament and the export trades. The tendency is to favour shares of companies with widespread and varied chemical and kindred interests.

Imperial Chemical have been more active and have recently strengthened to 42s. 6d., on general confidence that the year's total dividend will again be 10 per cent. Fisons firmed up to 25s. 3d. after an earlier small decline. Monsanto have been steady at 50s., with Albright & Wilson 5s shares at 30s. 9d. Boake Roberts eased to 34s. Amber Chemical 2s. shares were 2s. 6d., F. W. Berk, 12s. 6d., Bowman Chemical, 5s. 9d., Brotherton, 21s. 3d., and Pest Control, 7s. 3d. W. J. Bush rose further to 82s. 6d. and the company's 5 per cent preference were 22s. 9d.

Dunlop Rubber rallied to 54s. 3d., British Oxygen, at 86s., showed firmness again on the success of the big new issue, and higher dividend hopes were inclined to draw rather more attention to Turner & Newall at 82s. United Molasses, at 46s., have also strengthened a little. The 4s. units of the Distillers Co., at 19s 3d., held steady and Lever & Unilever at 41s. were also well maintained.

British Aluminium at 38s. 6d. improved a little. Triplex Glass, at 26s. 6d., showed firmness, on the expectation of a further increase in dividend this year.

There was again little movement in iron and steel shares. Guest Keen at 47s. 9d. were a little lower on balance. Dorman Long, at 31s., lost an earlier small improvement. Electrical equipment shares were inclined to ease because of the growing shortage of zinc.

Boots Drug at 48s. 6d. held up quite well, Borax Consolidated 55s. 6d. were again firm, and General Refractories, at 24s. 3d., held most of their recent improvement. Tube Investments, at £6¼, were well maintained on the news that five million new preference shares are to be offered to shareholders at 20s. each. There was again a good deal of activity in Glaxo Laboratories around 56s. 6d., on the view that when more capital is required it is likely to be raised by an offer of additional shares to shareholders.

Oil shares have firmed up on news of a further increase in U.S. crude oil prices. Shell were better at 65s.

Market Reports

THERE has been little change in the position on the home market for industrial chemicals where an active demand continues to be experienced in most sections. The volume of export inquiry is well maintained though actual bookings for shipment are in some cases restricted by a shortness of supplies. The price of acetone was increased last week and the product is now £15 per ton higher. With the undertone throughout the market remaining strong some price increases would seem probable although no actual changes have been notified at the time of going to press. Trade in the coal tar products was steady but supplies of some items are becoming increasingly difficult, particularly the light distillates.

MANCHESTER.—Strong price conditions continue in most sections of the Manchester chemical market. Buyers are experiencing difficulty in covering some of their requirements. A wide range of products for the textile and allied trades are in good demand and other leading industrial chemicals are finding a steady outlet. Delivery specifications for these are circulating freely and there has been a fair amount of replacement business during the past week. The demand for fertilisers generally has been only moderate but there is a steady trade in most tar products.

GLASGOW.—Business in the Scottish heavy chemical market remained steady during the past week. There was an increasing demand but chemical supplies in most cases were limited. There has been no change in the export market.

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

MORLEYS ESSEX LIME CO., LTD., Newport (Essex). (M., 16/12/50.) November 10. £2000 debenture to W. Taylor, Worlington; general charge.

ORGANIC DYESTUFFS, LTD., Salford. (M., 16/12/50.) November 8, debenture to Barclays Bank Ltd.; general charge. *Nil. August 28, 1948.

A. S. PRICE AND CO., LTD., Birmingham, chemists. (M., 16/12/50.) November 9, £8700 mortgage, to Rowley Regis and District Benefit Building Society; charged on land, warehouse and premises at Corngreaves Road, Cradley Heath. *£5895. December 31, 1946.

D. RILEY, LTD., Liverpool, chemists. (M., 16/12/50.) November 7, charge as confirmed and ratified by a resolution dated October 24, 1950, to Barclays Bank Ltd.; charged on 65 William Henry Street, Everton, Liverpool. *Nil. July 18, 1950.

Satisfaction

WESTERN OXIDE AND PAINT CO., LTD., Slough. (M.S., 16/12/50.) Satisfactions November 7, of mortgages registered September 17, 1948, and January 19, 1950.

Release of Receivership

ANSOL CHEMICAL CO., LTD., 4 Broad Street Buildings, E.C.2. Eric S. Smith, of Faraday House, 17 Todd Street, Manchester, ceased to act as receiver on November 9, 1950.

Company News

Nitrate Merger

The Lautaro Nitrate Co., and the Anglo-Chilean Nitrate Corporation have announced that full information of the proposed merger of the two companies will be submitted to shareholders as soon as the legal and other problems involved have been considered, and a complete plan developed.

New Registrations

Gordon Chemical Company, Ltd.
Private company. (488,924). Capital £1000. Manufacturers of chemicals, liquids and gases, alkalis, acids, plastics, fabrics and synthetic preparations. Directors: R. I. Burr and G. A. Burr. Reg. office: Cliffords Inn, E.C.4.

Descalite Chemical Industries, Ltd.
Private company. (488,917.) Capital £1000. Manufacturers of compositions and solutions for the removal of scale from boilers, domestic and industrial equipment, etc. Directors: F. G. Kafell and J. H. W. Bowen. Reg. office: 1 Peel Road, South Woodford, E.18.

A. W. Munns & Co., Ltd.
Private company. (489,145). Capital £25,000. Manufacturers, importers and exporters of perfumes, oils, essences, etc. Subscribers: Mrs. G. L. Munns and A. W. Munns. Solicitors: Freshfields, 1 Bank Buildings, Princes Street, E.C.2.

Rubber Suspension, Ltd.
Private company. (489,008). Capital £1000. Manufacturers of component parts of complete units in moulded rubber, ebonite, latex or thermosetting plastic materials. Directors: E. E. Wynn and C. Wynn. Reg. office: 121 Finchfield Lane, Wolverhampton.

NEXT WEEK'S EVENTS

TUESDAY, DECEMBER 19

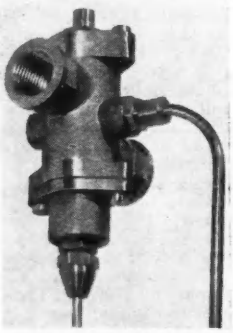
Society of Chemical Industry
London: Manson House, Portland Place, W.1. 6.30 p.m. A. Fowler Williams: "A New Monomer, Acenaphthylene, Its Polymers and Copolymers."

Mr. George Mackay

THE death has occurred at his home, 12 Prospecthill Road, Glasgow, of MR. GEORGE MACKAY, a director of Messrs. W. and R. Hatrick, Ltd., manufacturing chemists, Glasgow. A native of Helmsdale, Sutherland, where he served his apprenticeship as a chemist, Mr. Mackay came to Glasgow in 1880 to join the staff of W. and R. Hatrick. He travelled for the firm for a number of years, and became well known to doctors and chemists over a wide area of Scotland. In 1934 he was appointed a director, and last month completed 70 years' service. Mr. Mackay, who was widely known in Masonic circles, was 89 years of age.

Technical Publications

AN automatic pilot device which can be used either on town's or liquefied fuel (petroleum) gases is the Teddington Type TJ, described by the British Thermotsat Co., Ltd., in its advance technical publication AT/25A. The device comprises four main components: a shut-off valve and an electromagnet contained in the main housing, and remote from it, a thermocouple and pilot burner. The thermocouple is positioned within the pilot flame, and the current thus generated energises the electromagnet and holds open the valve, which remains open as long as the pilot flame is properly alight. But if the flame becomes extinguished (for any reason whatever) the thermocouple ceases to energise the electromagnet, the armature is released, and the valve closed with a positive snap action.



[By courtesy of The British Thermostat Co., Ltd.

CYANIDE regeneration applied to the treatment of refractory, complex or copper bearings ores as practiced by the Compania de Real del Monte y Pachuca, Hidalgo, Mexico, is described by Frank A. Seeton, in "Deco Trefoil" (Vol. 14, No. 5) published by the Denver Equipment Co., Colorado, U.S.A. Silver ore is treated in the modern cyanide plant Pachuca at the rate of 3100 metric tons per 24 hours. Addition of flotation to the cyanide circuit has resulted in increased precious metal recovery and important amounts of copper and lead.

* * *

CHEMISTRY of iron and steelmaking played an important part in the research and development programme for the year ending 30 June of the United Steel Companies, Ltd. The construction of extensive new laboratories has been undertaken at Swinden House, Rotherham. It is hoped that the new buildings covering approximately 45,000 sq. ft. of working floor area will be in possession of the research department by the end of next year. These facts are given in the second report to the staff and employees issued by the company as a "Review of Progress 1950." The brochure contains a number of striking photographs and some useful charts and diagrams.

* * *

PROBLEMS of flaking in continuous vertical retorts form the main section of the 41st report of the refractory materials joint committee of the Gas Research Board and the British Ceramic Research Association, which has now been issued as Communication GRB. 58.

* * *

ION EXCHANGE is the subject of a booklet just issued by the British Drug Houses, Ltd., in which "Notes on the Laboratory Use of Ion Exchange Resins" are given. The general concepts of ion exchange technique are considered and applications of the resins in analysis, as catalysts, and in various physico-chemical determinations, are discussed. Reference is made throughout to the Amberlite series of resins, which B.D.H. distribute in Great Britain for the Rohm & Haas Company of America. A useful list of literature references is appended.

* * *

FILMS on scientific and medical topics—which may be borrowed free of charge—are listed in the new I.C.I. film catalogue just published. The catalogue is divided into five main sections: medical, agricultural, general interest, films for schools, and films about I.C.I. All the films are sound films and are in the 16 mm. size only. Many are coloured. Further information regarding the loan of these films may be had from the I.C.I. Film Library, Bolton House, Curzon Street, London, W.1.

Record Wolfram Price

Wolfram prices reached a new high level on 11 December, being quoted at 325s. to 345s. nominal per unit c.i.f. European ports. The previous peak level was about 160s. in 1947. At the beginning of January this year the price was 90s. to 95s. per unit (against 75s. a unit at the time of devaluation) from which it has gradually risen to the present record.

Need for Synthetic Rubber

THE need to establish a synthetic rubber industry in the United Kingdom, even under conditions of an assured world peace, was stressed by Mr. G. E. Beharrell, Dunlop's managing director, at the Institution of the Rubber Industry dinner in London on 8 December.

British consumption of rubber, said Mr. Beharrell, had risen from 18,000 tons to 215,000 tons since 1921. "The worsening international situation and the urge for stockpiling by our friends, chiefly in the United States of America, has," he said, "altered the whole statistical, commercial, and technical problems of our industry. The year 1950 has seen the revival on a large scale of the great synthetic rubber industry.

"When U.S. stockpiling is completed," he asserted, "it is difficult, in spite of the obvious appreciation over there of the importance of the Far Eastern economy in world peace and for the need of economic expansion in the Far East, to visualise the return of the synthetic rubber indusry to volumes which were under contemplation only some twelve months ago."

Price levels were so high that they threatened the expansion of important technical developments which would be required if a reasonable adjustment between supply and demand was to be maintained.

Technical and marketing research must be continued at the highest level. "Our position," said Mr. Beharrell, "viewed from the point of view of war potential, would also warrant further examination."

IN THE EDITOR'S POST

Estimating Moisture

SIR,—In the recent article by Mr. Alan H. Ward on "Methods of Estimating Moisture" we would agree that the most accurate method is the simple drying method. He says, however, that it takes up to three hours and if our experience is any guide it would be difficult to find an operator who could do 150 tests in an eight hour day. With a large number of materials too, the first sample would have lost in weight before 50 samples could be weighed.

To the scientist, however, facts are important and as British manufacturers of the Brabender Moisture Tester we should like to point out that there is no spring balance in the apparatus. The balance has knife edges on the chemical balance principle. Contrary also to Mr. Ward's statements the oven is tied neither to times or temperatures. The current of air is the essential future of the machine. (This principle has been accepted by the Government laboratory in their tests on tobacco.)

If figures are important, in America a time of half an hour is given for ten tests which on an eight hour day gives 160 moisture tests a day. We ourselves would merely state that the Brabender Moisture Tester has been in use all over Europe, America and England for the last twenty years which speaks well for the principles it embodies.—Yours faithfully,

E. E. Voss, B.Sc.

Voss Instruments, Ltd.

Brazilian Caustic Soda Development

THE Companhia Nacional De Alcalis (THE CHEMICAL AGE, 22 April, 1950, page 579) appears to have overcome its financial difficulties and should start building the factory at Cabo Frio within the next few months. The Export-Import Bank of Washington is to increase its loan from 7.5 to 10 million dollars and the Bank of Brazil will advance 50 million cruzieros £1,000,000). The factory is designed for an output of 45,000 tons of caustic soda, 33,000 of barilla and 4,000 of bicarbonate. The existing factories in Rio and San Paulo produce only 4,000 tons of caustic soda annually, by electrolytic processes, while national consumption amounts to 90,000 tons of caustic soda and 60,000 of barilla. The construction of a second factory, similar to that at Cabo Frio, is therefore under consideration.

The cost of producing caustic soda and barilla at Cabo Frio is estimated, perhaps somewhat optimistically, at 814 and 329 cruzieros (£16 5s. 7d. and £6 11s. 7d.) per ton, while the market prices for British products are in the order of 2400 and 1200 cruzeiros.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

DESIGN ENGINEERS, with B.Sc. Degree in Mechanical Engineering or equivalent, and not over 40 years of age, are required by The Bahrein Petroleum Company, Limited. Experience to have been in design of Oil Refineries, coal tar, chemical distillation or similar plants, involving electrical and steam systems, pressure vessels, fractionating columns, heat exchange and pumping equipment. Salaries according to qualifications and experience, plus kit allowance. Provident Fund. Free board and air-conditioned accommodation, medical attention. Low living costs. Two-year agreements with paid leaves and transportation. Write, giving full particulars of age, education and experience, to **Box 3785, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London, E.C.4.**

EXPERIENCED PRODUCTION MANAGER required for Midland Works manufacturing Chemical Foundry Supplies. Write, in confidence, stating fullest particulars of age, experience, etc., to Box No. C.A. 2962, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

NON-FERROUS Metal Manufacturers situated East London invite applications for the following posts:

1. **ANALYST**—University Degree or similar qualification, age not over 36 years. Starting salary £600-£650 per annum according to qualifications and practical experience offered.
2. **SHIFT SUPERVISOR.**—Applicant must possess chemical or metallurgical qualifications, should have experience in handling labour. Age 28-35. Minimum salary £550 per annum and according to qualifications and experience.
3. **ASSISTANT SAMPLER.**—Intelligent young man of integrity approx. 25 years. Knowledge of or interest in chemistry/metallurgy preferred, to act as assistant sampler. Salary £7. 10. 0. per week.
4. Youth required as **LABORATORY ASSISTANT.** Education Secondary School standard. Interested in/with knowledge of chemistry, intending to study for qualifications. Salary by arrangement. Company provides holidays with pay, pension scheme and excellent staff facilities in modern premises.

Applications should state clearly the post applied for and should give full details of training, qualifications and experience, to Personnel Manager, Box No. C.A. 2965, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

NORTHAMPTON POLYTECHNIC
St. John Street, London, E.C.1.

APPLICATIONS are invited for the post of **LECTURER IN CHEMISTRY** in the Department of Applied Chemistry. Candidates should be of good academic standing, industrial and/or research experience would be an added qualification. Salary on London Burnham Scale which is basically £336 to £603 per annum plus additions of between £30 and £60 according to qualifications. The Burnham Scales are under review. Application forms to be returned as soon as possible. Further details and form of application may be obtained from the Secretary.

OIL Refinery Contractors handling large contracts for Refinery Plant, require **CONTRACT ENGINEERS** in their London Office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience of Refining Industry or Heavy Engineering, including a wide knowledge of pumping, heat-exchange equipment and instrumentation, and the appointment offers excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience, to **Foster Wheeler, Ltd., 3, Ixworth Place, London, S.W.3.**

SITUATIONS VACANT

PLANT DEVELOPMENT AND PROCESS ENGINEERS, qualified in Chemical Engineering or Petroleum Refining Technology, required by Bahrein Petroleum Company, Limited. Age limit, 25-40. Two-year agreement periods with passages and paid leaves. Free air-conditioned accommodation, board and medical attention, kit allowance, low living costs. Salary according to experience. Write, with full particulars of age, education, experience, to **Box 3784, c/o Charles Barker & Sons, Ltd. 31, Budge Row, London, E.C.4.**

PROCESS DEVELOPMENT CHEMISTS required by large Chemical Manufacturers in the Manchester area. Applicants should possess a degree (or equivalent) in Chemistry and at least three years' experience in research and development is desirable. Salary range, £450-£750, according to qualifications and experience. Shift work will have to be carried out during the first year of employment, but after that will be occasioned only by necessity. (A shift allowance is payable where relevant). Generous non-contributory Staff Assurance Scheme. Box No. C.A. 2963, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

The Civil Service Commissioners invite applications for appointments as **SENIOR SCIENTIFIC OFFICER** and **SCIENTIFIC OFFICER** to be filled by competitive interview during 1951. Interviews will begin in January and will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1951, may eventually be announced. Successful candidates may be appointed immediately. The posts are in various Government Departments and cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. Candidates must have obtained a university Degree with first or second class honours in a scientific subject (including engineering) or in mathematics, or an equivalent qualification, or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer posts taking their degrees in 1951 may be admitted to compete before the result of their Degree examination is known.

Age limits for Senior Scientific Officers, at least 26 and under 31 on 1st August, 1951; for Scientific Officers, at least 21 and under 28 (or under 31 for established civil servants of the Experimental Officer class) on 1st August, 1951. Salary scales for men in London, Senior Scientific Officers, £700 × 25—£900; Scientific Officers £400 × 25—£650. Rates for women are somewhat lower.

Further particulars from the **Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1., quoting No. 3399.** 9539/250/MB.

FOR SALE

GRAVITY CONVEYORS, rollers 24 in., 18 in., 14 in. and 9 in. wide on 6 in. and 4 in. pitch, with curves and stands.

PORTABLE SLAT CONVEYORS. Oak slats, 17 in. wide by 22 ft. long, adjustable delivery height, 4 ft./14 ft., for bags or boxes, etc.

Copper-lined **STEAM JACKETED PAN,** 25 gals. on three legs.

Vertical Cross-tube **STEAM BOILER,** 8 ft. 6 in. by 3 ft. 6 in. diam., 80 lb. w.p.

KIMMINS & SONS, Lyndhurst Road, Worthing.

FOR SALE

VARIOUS MIXERS FOR SALE

BAND CONVEYOR, 50 ft. long 40 in. wide, steel frame, motorised, for boxes, cases, bags, etc.

A **FILTER PRESS,** 31½ in. square, fitted with 42 C.I. plates, centre fed.

FILTER PRESS, 25 in. square, fitted with 24 plates, cast iron built and steam heated.

Four **GARDNER HORIZONTAL MIXERS,** for powders, from 100 lbs to 250 lbs. capacity, all motorised, three with Radicon Reduction Gear Boxes and one with a Spur Gear Drive.

Two large unjacketed **WERNER MIXERS,** belt and gear driven, hand tipping, double "Z" arms, pans 53 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw.

No. 204 One **WERNER PFLEIDERER MIXER OR INCORPORATOR,** similar to the above, with a C.I. built pan 25 in. by 25 in. by 19 in. deep, belt pulleys 26 in. diam. by 5 in. face, double fin-type agitators, and mounted on C.I. legs.

No. 208 One **DITTO** by **WERNER PFLEIDERER,** with a C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 5 in. long by 3 ft. 8 in. by 33 in. deep, with double "Z" mixing arms, gears at each end, hand-operated tilting gear, with steel backframe, counterbalancing weights and chains, and fast and loose pulleys 3 ft. diam. by 6 in. face.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

No. 211 One **HORIZONTAL MIXER** as above.

These three "U"-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

Further details and prices upon application.

Write RICHARD SIZER LIMITED, ENGINEERS CUBER WORKS, HULL

1000 STRONG NEW WATERPROOF APRONS. To-day's value 5s. each, Clearing at 30s, dozen. Also large quantity Filter Cloths, cheap. Wilsons Springfield Mills, Preston, Lancs Phone 2198.

FOR SALE

600

TWIN roll **FLAKING MACHINE** by **BERTRAM,** with C.I. rolls 60 in. long by 28 in. dia. Drive through helical gearing from 4.5 h.p. reduction gearbox, ratio 160/35, with pulley. Rolls suitable 40 lb. W.P.

STAINLESS STEEL EQUIPMENT in stock for immediate delivery. Storage vessels up to 1,000 gall., heating and cooling coils, buckets, portable stirrers, tables, measures, scoops, funnels, etc.

New portable **TROUGH BELT CONVEYOR** 30 ft. centres by 16 in. wide, discharge height 10 ft. to 12 ft.

New portable **WOODEN SLAT CONVEYOR** 15 ft. centres by 21 in. wide, discharge height 6 ft. to 11 ft.

Stainless steel horizontal **VESSEL,** 6 ft. long by 3 ft. 5½ in. diam., one end hinged with quick-release bolts, fabricated from 10G. 15 in. manway on top, lagged with cork. Dull polished, mounted on trolley.

Steam heated **DRYING OVEN** by **AIRSCREW,** continuous type, twin compartment 50 ft. long. Air circulation and heat control. 30/50 lb. W.P. 3,000 to 4,000 lbs. evaporation. Trolleys mechanically hauled.

GEORGE COHEN SONS & CO. LTD.
SUNBEAM ROAD, LONDON, N.W.10.
Tel. ELGar 7222 and
STANNINGLY, Nr. LEEDS.
Tel.: Pudsey 2241.

ABELSON

SEVERAL large **OAK VATS** 6-40,000 gallons capacity.
30 in. Broadbent electric **HYDRO EXTRACTOR** 400/3/50.
36 in. Manlove Alliott electric **HYDRO EXTRACTOR** 230/1/50.
TWO stainless steel **MIXING VESSELS** 5 ft. 9 in. dia. by 7 ft. 11 in. deep.
ONE horizontal **AUTOCLAVE** 30 ft. by 9 ft. dia. 100 lb. W.P.
Oval and rectangular jacketed **VACUUM OVENS.**
FOUR 1½ in. Mitchell **ACID PUMPS** 66 g.p.m.
ONE 2½ in. Mitchell **ACID PUMP** 105/132 g.p.m.
ONE 4 in. British LaBour **ACID PUMP** 350 g.p.m.
Enquiries invited all types chemical plant.
ABELSON & CO. (ENGINEERS), LTD.,
333, Station Road, Harrow, Middlesex.
Tel. : Harrow 2253.

B.C.S.
BOILERS

(A) 2,500 lb. pr hour Danks Self-contained **ECONOMIC BOILER,** new 1943; 6 ft. diam. × 11 ft. 9 in. overall length; heating surface, 420 sq. ft.; working pressure, 100 lb.; complete with Crosthwaite grate; F.D. fan, chimney, Hilo alarms, fittings and mountings.

(B) 1,320/1,760 lb. per hour No. 9 Size Cochran **VERTICAL MULTITUBULAR BOILER,** new 1930; 5 ft. 3 in. diam. × 11 ft. 9 in. high; 100 lb. working pressure; complete with Prior automatic stoker, valves, fittings, etc.

(C) 1,250/1,650 lb. per hour No. 16 Size Ruston **THERMAX VERTICAL MULTITUBULAR BOILER,** new 1941; 4 ft. 7 in. diam. × 11 ft. 3 in. high; 100 lb. working pressure; complete with grate for hand firing, fittings and mountings, Royles' feed regulator, Hotwell tank, Weir feed pump, chimney, piping.

(D) 750 lb. per hour Beaver **VERTICAL CROSS-TUBE BOILER,** new 1935; 3 ft. 6 in. diam. × 9 ft. high; 100 lb. working pressure; complete with fittings and mountings, Royles' feed regulator, Weir feed pump, piping, etc.

B.C.S. (ENGINEERS & CONTRACTORS) LTD.,
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Cardiff.
Tel. : Cardiff 8512/3/4.

FOR SALE

MORTON, SON AND WARD LIMITED,
—OFFER—
MIXERS, ETC.

THREE horizontal totally enclosed **MIXERS** measuring 9 ft. long by 3 ft. 6 in. dia. constructed welded ¼ in. plate, manhole and discharge, motorised or fast and loose pulley drives.
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